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1931

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Affiliated with the American Association for the Advancement of Science

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Date of Publication, August 20, 1931

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Delaware.....1909
Granville.....1903, 1908
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Oxford.....1907, 1931
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'30. PEPPERBERG, LEON J., *Petroleum Geology, Economic Geology, Scientific Geologic Problems, Geophysical,*
Columbia Engineering & Management Corp., 99 N. Front St., Columbus
'25. PERSING, MRS. ELLIS C., *Biology,*
Cleveland School of Education, Stearns Road, Cleveland
'21. PETERS, HAROLD S., *Mallophaga of U. S., Entomology, Ornithology,*
Bureau of Entomology, Washington, D. C.
'29. PETERSON, ALVAH, (F '30), *Entomology*.....O. S. U., Columbus
'26. PETTAY, FRED, Botany.....Troy
'31. PHEE, REV. MARTIN J., *Biology,*
Xavier University, Victory Parkway, Cincinnati
'26. PHILIPS, JAMES MCIVOR, *Medical Sciences*.....Galloway
'30. PIERSOL, GUTHRIE, *Psychology*.....Marietta College, Marietta
'31. PIERSTORFF, A. L., *Botany*.....Botany Dept., O. S. U., Columbus
'15. PLOWMAN, AMON B., (F '20), *Botany, Physiology, Zoology,*
596 Greenwood Ave., Akron
'24. POLLITZ, LOUISE C., *Geology, Geography, Ecology,*
26 Jefferson Ave., Oshkosh, Wis.
'30. PONTIUS, LESLIE L., *Botany, Zoology*.....170 W. High St., Circleville
'25. POOS, F. W., *Entomology*.....Arlington Farm, Rosslyn, Va.
'27. PORTER, JAMES P., (F '30), *Psychology*.....Ohio University, Athens
'26. PRATT, KARL C., *Psychology*..Educational Bldg., O. S. U., Columbus
'22. PRESSEY, MRS. LUELLA W., *Psychology,*
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'22. PRESSEY, SIDNEY L., *Psychology,*
Dept. of Psychology, O. S. U., Columbus
'25. PRICE, JOHN W., *Zoology*.....Dept. of Zoology, O. S. U., Columbus

'12. RANKIN, JOHN P., *Biology, Medicine*.....Elyria S. & T. Bldg., Elyria
'31. RAUCH, R. P., *Psychology*.....44 S. Burgess Ave., Columbus
'22. RAUP, HUGH M., *Zoology, Botany,*
Dept. of Botany, Wittenberg College, Springfield
'21. REA, PAUL M., (F '23), *Natural History Sciences, especially Zoology,*
357 W. Lancaster Ave., Ardmore, Pa.
'31. REID, W. M., *Botany, Entomology, Geology*.....155 E. Union St., Circleville
'26. RENSHAW, SAMUEL, (F '30), *Psychology,*
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'01. RICE, EDWARD L., (F '20), *Zoology*.....O. W. U., Delaware
'30. RICHARDS, ELIZABETH PUTNAM, *Geology, Geography*..271 Forest St., Oberlin
'31. RIDDELL, NEWTON N., *Psychology, Biology*.....P. O. Box 408, Lima
'31. RIECKEN, WILLIAM E., *Botany*.....1018 N. Washington St., Kokomo, Ind.
'28. RIELLEY, LENDELL CHARLES, *Psychology*.....Wilberforce University, Xenia
'21. RILEY, C. L., *Biology, Geology*.....1226 Fourteenth St. N. W., Canton
'30. RING, DEWITT T., *Geology, Paleontology, Geography,*
99 N. Front St., Columbus
'31. ROACH, LEE S., *Zoology, Animal Ecology*.....Athens
'30. ROBERTSON, L. A., *Botany*.....427 E. Fourteenth Ave., Columbus
'14. ROBINSON, J. M., *Entomology*.....Box 247, Exp. Sta., Auburn, Ala.
'19. ROGERS, A. SOPHIE, (F '27), *Psychology*.....52 E. Pacemont Rd., Columbus
'13. ROGERS, CHARLES G., (F '20), *Physiology*...378 Reamer Place, Oberlin

'14. ROOD, ALMON N., *Botany*.....R. F. D. No. 2, Phalanx Station
'21. ROOTS, YALE K., *Physics*....100 Washington Square E., New York City
'25. ROTH, CONRAD, *Ornithology, Botany, Forestry*,
1715 Robinson Ave., Portsmouth
'25. ROWLES, EMMETT, *Zoology, Medical Sciences*.....97 Franklin Ave., Athens
'22. RUNNELS, HARMON A., *Botany*,
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'18. SAMPSON, HOMER C., (F '20), *Botany*.....O. S. U., Columbus
'28. SAVAGE, JOHN R., *Entomology, Zoology, Ecology*,
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'31. SAWYER, DR. CARL W., *Medical Sciences*.....White Oaks Farm, Marion
'21. SAYRE, JASPER D., (F '22), *Botany*,
Ohio Agricultural Experiment Station, Wooster
'31. SCHAEFER, FRANCES, *Geology*.....383 Oakland Park Ave., Columbus
'27. SCHAEFER, J. E., *Geology, Mineralogy*.....13212 Superior St., Cleveland
'97. SCHAFFNER, JOHN H., (F '20), *Botany*.....O. S. U., Columbus
'13. SCHEAR, E. W. E., *Biology*.....107 W. Park, Westerville
'07. SCHEFFEL, EARL R., *Geology*.....326 W. Nassau St., St. Peter, Minn.
'30. SCHMIDT, JACOB J., *Geology*.....East Ohio Gas Co., Cleveland
'27. SCHNEIDER, ELIZABETH, *Biology*.....514 N. Wittenberg Ave., Springfield
'31. SCHOFF, C. N., *Geology*.....61 S. Professor St., Oberlin
'29. SCHOFF, STUART L., *Geology*.....1590 Neil Ave., Columbus
'25. SCOTT, JOSEPH M., *Bacteriology, Animal Parasitology*,
1415 Inwood, Alliance
'31. SCOTT, THURMAN C., *Psychology*.....34½ N. Congress St., Athens
'25. SCOTT, LUTHER C., *Geology*.....Toledo University, Toledo
'15. SEARS, PAUL B., (F '21), *Botany, Entomology*,
University of Oklahoma, Norman, Okla.
'26. SEASHORE, ROBERT H., *Psychology*.....958 E. 21st St., Eugene, Ore.
'22. SECREST, EDMUND, (F '24), *Forestry*,
Ohio Agricultural Experiment Station, Wooster
'28. SEGELKEN, JOHN G., *Botany*,
Fairmount Ave., Burnham Park Estates, Morristown, N. J.
'26. SELBERT, (MRS.) NORMA, *Medical Sciences*,
Hamilton Hall, O. S. U., Columbus
'14. SEYMOUR, RAYMOND JESSE, (F '20), *Physiology, Zoology, Botany*,
Dept. of Physiology, O. S. U., Columbus
'12. SHADLE, ALBERT, *Zoology*,
Dept. of Biology, University of Buffalo, Buffalo, N. Y.
'31. SHARP, HENRY S., *Geology*.....Granville
'11. SHARP, MRS. KATHARINE DOORIS, (F '28), *Botany, Geology*.....London
'08. SHATZER, C. G., (F '20), *Geology, Geography*,
1003 Woodlawn Ave., Springfield
'30. SHELTON, G. R., *Geology and Physical Sciences*,
Bureau of Standards, Lord Hall, O. S. U., Columbus
'31. SHENKER, SAMUEL, *Chemistry*.....649 Lilley Ave., Columbus
'15. SHETRONE, H. C., ('29), (F '31), *Archaeology*, Ohio State Museum, Columbus
'13. SHIDELER, W. H., (F '20), *Geology*.....Miami University, Oxford
'29. SHUMAN, HELEN WOODBURN, *Geology, Psychology*.....Salesville

'15. SHUMAN, S. C., *Botany*.....Greenwich
'13. SHUMAN, W. L., *Botany*.....South Euclid
'31. SIMONTON, OWEN W., *Geology*.....Room 12, Quinby Bldg., Wooster
'28. SIMPSON, WALTER, *Medical Science, Pathology*,
Miami Valley Hospital, Dayton
'28. SLAGG, RODNEY A., *Botany, Geology*.....433 E. Buchtel Ave., Akron
'31. SLAVENS, MARGARET D., *Geography, Geology*,
Muskingum College, New Concord
'29. SLEESMAN, GEORGE B., *Botany, Entomology*.....S. Union St., Ada
'27. SLEESMAN, J. P., *Zoology, Entomology*,
Ohio Agricultural Experiment Station, Wooster
'12. SMITH, ALPHEUS W., ('22; F '22), *Physics*.....O. S. U. Columbus
'16. SMITH, CLAYTON S., *Medical Sciences*, Hamilton Hall, O. S. U., Columbus
'21. SMITH, ERNEST RICE, (F '21), *Geology, Paleontology*,
309 Greenwood Ave., Greencastle, Ind.
'30. SMITH, FLOYD F., *Entomology, Zoology, Botany*,
Arlington Farm, Rosslyn, Va.
'30. SMITH, GUY HAROLD, *Geography and Geology*,
Dept. of Geography, O. S. U., Columbus
'29. SMITH, ISABEL SEYMOUR, *Botany*.....145 Woodland Ave., Oberlin
'31. SMITH, J. J., *Social Psychology*.....109 Lakeside, New Concord
'27. SNIDER, GEORGE GOULD, *Zoology, Medicine, Botany*..Address unknown
'02. SNYDER, F. D., *Zoology, Ethnology*.....235 Main St., Ashtabula
'31. SNYDER, LAWRENCE H., *Zoology, Genetics*,
Dept. of Zoology, O. S. U., Columbus
'29. SPAHR, GEORGE T. (**), *General Science*.....514 E. Town St., Columbus
'22. SPENCER, HERBERT, *Entomology, Zoology, Ecology*,
Louisiana Experiment Station, Baton Rouge, La.
'25. SPENCER, WARREN P., (F '29), *Zoology*.....702 College Ave., Wooster
'26. SPIEKER, EDMUND M., (F '27), *Geology*, Orton Hall, O. S. U., Columbus
'18. SPOHR, CARL F., (F '20), *Medical Sciences*, Medical Dept., O. S. U., Columbus
'31. SQUIRES, G. R., *Geology, esp. Coal Formation Fossils*,
4092 Mayfield Rd., South Euclid
'29. SQUIRES, H. D., *Geology*.....Orton Hall, O. S. U., Columbus
'29. STANNARD, J. NEWELL, *Geology, Chemistry*.....65 N. Pleasant St., Oberlin
'31. STARK, ORTON K., *Botany*.....Oxford
'05. STAUFFER, CLINTON R., (* F '20), *Geology*,
University of Minnesota, Minneapolis, Minn.
'31. STEHR, WILLIAM C., *Zoology, Entomology*,
Biology Dept., Ohio University, Athens
'30. STEPHENSON, LEONARD L., *Botany and several branches of Biology*....Buchtel
'31. STETSON, HARLAN TRUE, *Physical Sciences*,
Perkins Observatory, O. W. U., Delaware
'25. STEWART, GRACE A., (F '27), *Geology*.....O. S. U., Columbus
'03. STICKNEY, M. E., (F '20), *Botany*.....Denison University, Granville
'22. STOCKDALE, PARIS B., (F '24), *Geology*,
Dept. of Geology, O. S. U., Columbus
'20. STONE, JULIUS F., *General Science*.....Grandview, Columbus
'31. STONE, ROBERT GRANVILLE, *Geography, Physiography, Geology*,
229 W. Eleventh Ave., Columbus

'26. STOUT, GILBERT LEONIDAS, *Botany, Genetics,*
State Dept. of Agriculture, Sacramento, Calif.
'15. STOUT, HARRY O., *Botany, Geology, Agriculture, Zoology,*
Bowling Green High School, Bowling Green
'08. STOUT, W. E., (F '20), *Chemistry, Ceramics, Geology,*
154 Erie Road, Columbus
'20. STOVER, ERNEST L., (F '30), *Botany,*
Eastern Illinois Normal College, Charleston, Ill.
'09. STOVER, W. G., (F '20), *Botany, Plant Pathology*.....O. S. U., Columbus
'29. STUPKA, ARTHUR, *Nature Study*.....66 W. Tenth Ave., Columbus
'30. SURRARRER, THOMAS, *Zoology*.....R. F. D. No. 1, Berea
'29. SWINGLE, MARY, *Biology*.....Box No. 32, Philo
'23. SWINNERTON, ALLYN C., (F '27), *Geology,*
Antioch College, Yellow Springs

'28. TASHIRO, SHIRO, (F '29), *Medical Sciences, Chemistry,*
University of Cincinnati, Cincinnati
'31. TAYLOR, DR. A. M., *Botany, Zoology, Forestry, Horticulture, (any Biological Science)*.....Lake Erie College, Painesville
'19. TAYLOR, MRS. BAYARD, *Botany, Ornithology*.....West Jefferson
'25. TAYLOR, L. W., (F '29), *Physical Sciences*.....30 N. Pleasant St., Oberlin
'26. TEDESCHE, LEON G.....416 Catherine St., Cincinnati
'25. TERWILLIGER, CHARLES VAN ORDEN, *Physical Sciences,*
186 Gloucester St., Annapolis, Md.
'28. THEIS, CHARLES V., (F '29), *Geology,* University of Cincinnati, Cincinnati
'25. THIESSEN, NORMAN W., *Chemistry, Biology*...160 Kent St., Brookline, Mass.
'19. THOMAS, EDWARD S., *Ornithology,*
Ohio Archaeological and Historical Museum, O. S. U., Columbus
'15. THOMAS, ROY C., (F '23), *Botany, Zoology, Geology,*
Ohio Agricultural Experiment Station, Wooster
'25. THOMPSON, OSCAR E., *Zoology, Botany*..140 E. Fifteenth St., Holland, Mich.
'26. THUT, HIRAM F., *Botany*.....1501 Neil Ave., Columbus
'30. TIDD, WILBUR M., *Zoology*..Botany and Zoology Bldg., O. S. U., Columbus
'20. TIFFANY, LEWIS H. (F '23), *Botany,* Dept. of Botany, O. S. U., Columbus
'94. TODD, JOSEPH H. (F '25), *Geology, Archaeology,* Christmas Knoll, Wooster
'19. TOOPS, HERBERT A. (F '24), Dept. of Psychology, O. S. U., Columbus
'19. TOOPS, LAURA CHASSELL, *Psychology*..458 W. Eighth Ave., Columbus
'15. TRANSEAU, EDGAR N. (F '20), *Botany*.....O. S. U., Columbus
'26. TRAUTMAN, MILTON B., *Ornithology*.....618 S. Fifth St., Columbus
'19. TRETTIEN, A. W., *Psychology*.....Toledo University, Toledo
'30. TROYER, MAURICE E., *Psychology*.....Bluffton College, Bluffton
'29. TUCKER, FORREST G., (F '31), *Physics, Mathematics, Chemistry,*
99 S. Cedar St., Oberlin
'12. TURNER, CLARENCE L., (F '20), *Zoology,*
Northwestern University, Evanston, Ill.
'29. TWITCHELL, GEORGE B., (F '30), *Geology, Medical Sciences,*
845 Dayton St., Cincinnati

'31. UHRBROCK, RICHARD STEPHEN, *Psychology,*
Statistical and Research Dept., The Procter & Gamble Co., Cincinnati

'30. ULLMAN, ROY R., *Psychology*.....227 Ferrell Ave., Ashland
'30. UNIVERSITY OF CINCINNATI, *Library*.....Cincinnati

'26. VALENTINE, WILLARD L., *Psychology*.....346 Olentangy St., Columbus
'30. VAN CLEEF, EUGENE, *Geography, Climatology*,
Dept. of Geography, O. S. U., Columbus
'15. VAN CLEVE, M. R., *Physical Geography, Botany*,
Board of Education, Toledo
'21. VAN HORN, FRANK R., (* F '22), *Geology*,
Case School of Applied Science, Cleveland
'23. VAN HORN, JESSE LOWER, *Chemistry, Physics*,
1490 Roycroft Ave., Lakewood
'31. VARVEL, CARL DUDLEY, *Geography, Ethnography*,
Dept. of Geography, O. S. U., Columbus
'24. VER STEEG, CARL, (F '31), *Geology, Geography*..1030 Spink St., Wooster
'30. VINAL, W. G.....Western Reserve University, Cleveland
'26. VISSCHER, J. PAUL, (F '29), *Biology, Zoology, Medical Sciences*,
Western Reserve University, Cleveland
'15. VIVIAN, ALFRED, (F '20), *Agriculture, Chemistry*....O. S. U., Columbus
'30. VON OHLEN, FLOYD W., *Botany*.....Botany Dept., O. S. U., Columbus
'28. VON SCHLICHTEN, OTTO C., (F '29), *Geology*,
University of Cincinnati, Cincinnati

'04. WAITE, F. C., (F '20), *Anatomy, Zoology*..2109 Adelbert Road, Cleveland
'27. WALKER, CHARLES F., *Ornithology*.....53 Latta Ave., Columbus
'18. WALLER, A. E., (F '20), *Botany*,
Botany and Zoology Bldg., O. S. U., Columbus
'02. WALTON, L. B., (F '20), *Biology*.....Kenyon College, Gambier
'30. WARNER, DAVID CLARK, *Geography, Geology and Topograph, with special reference to Water Conservation*.....248 Pasadena Ave., Camp Chase
'30. WARNER, EDWARD N., *Ichthyology, Botany, Histology*,
Botany and Zoology Bldg., O. S. U., Columbus
'30. WATSON, D. A., *Biology, Botany and General Science*.....Batesville
'27. WEBSTER, CHARLOTTE E., *Geology, Botany, Ecology*,
300 Washington Ave., Elyria
'29. WEED, R. B., *Geology*.....805 Buckeye Bldg., Columbus
'31. WEIR, KENNETH J., *Entomology, Zoology, Botany*, R. F. D. No. 3, Ashtabula
'31. WELCH, WINONA H., *Botany*,
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'11. WELLS, B. W., (F '21), *Botany*,
North Carolina Agricultural College, Raleigh, N. C.
'24. WELTON, F. A., *Agronomy*,
Ohio Agricultural Experiment Station, Wooster
'91. WERNER, WILLIAM C., ('22), *Botany*.....352 N. St. Clair St., Painesville
'01. WESTGATE, LEWIS G., (F '20), *Geology*.....124 Oak Hill Ave., Delaware
'24. WHITE, GEORGE W., *Geology*,
Dept. of Geology, University of N. H., Durham, N. H.
'28. WHITE, MONICA, *Zoology, Botany*.....100 Center St., Struthers
'18. WICKLIFF, E. L., (F '23), *Zoology, Ornithology*,
Fish and Game Division, State House, Columbus

'25. WIEBE, ABRAHAM H., *Biology*..21 S. Biological Station, Fairport, Iowa
'25. WILCOX, R. B., *Botany*.....Whitesbog, N. J.
'22. WILLARD, C. J., (F '24), *Agronomy, Botany*.....O. S. U., Columbus
'25. WILLIAMS, C. G., *Botany*, Ohio Agricultural Experiment Station, Wooster
'21. WILLIAMS, R. D., *Philosophy, Psychology*,
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'03. WILLIAMS, STEPHEN R., (F '20), *Biology*.....300 E. Church St., Oxford
'97. WILLIAMSON, E. B., (F '31), *Entomology*.....Bluffton, Ind.
'24. WILSON, IRA T., *Zoology*.....Heidelberg University, Tiffin
'26. WILSON, ORVILLE TURNER, (F '31), *Botany, Bacteriology, Plant Pathology*.....University of Cincinnati, Cincinnati
'30. WING, DAVID GRANT, *Biology and Chemistry*,
Dept. of Geology, Miami University, Oxford
'26. WINNETTE, CLIFFORD L., *Geology, Chemistry*, R. F. D. No. 2, Canonsburg, Pa.
'29. WINSTON, MATTIE, *Geology*.....2314 Sauer Ave., Cincinnati
'15. WITHROW, JAMES R., (F '20), *Chemistry, Mineralogy*,
Chemical Engineering Dept., O. S. U., Columbus
'31. WITHROW, ROBERT B., *Plant Physiology*, University of Cincinnati, Cincinnati
'29. WOLFE, RICHARD E., *Biology, Physics, Chemistry*,
108 E. Maple St., Clyde
'30. WOLFORD, J. J., *Geology*.....Care of T. C. Wolford, Xenia
'29. WOLFRAM, GEORGE, *Ornithology, Nature Photography*,
1507 Michigan Ave., Columbus
'31. WOOD, C. C., *Psychology*.....University of Akron, Akron
'30. WRIGHT, ALFRED J., *Geography, Economics*,
Commerce Bldg., O. S. U., Columbus
'26. WRIGHT, FRANK J., (F '29), *Geology*.....Denison University, Granville
'29. WUESTNER, HERMAN, *Mineralogy*....3335 Cavanaugh Ave., Cincinnati
'20. WURDACK, MARY E., *Botany*.....68 Chatham Road, Columbus

'03. YORK, HARLAN H., *Botany*,
Dept. of Botany, University of Pennsylvania, Philadelphia, Penna.
'27. YOUNG, BOYD B., *Biology, Zoology*.....18 W. Perrin Ave., Springfield
'24. YOUNG, H. C., (F '26), *Botany*,
Ohio Agricultural Experiment Station, Wooster
'31. YOUNG, IRVIN F., *Botany, Zoology, Chemistry*..908 S. Ohio Ave., Columbus
'31. YOWELL, EVERETT I, *Astronomy, Mathematics*..3127 Griest Ave., Cincinnati

'29. ZURCHER, ESTHER R., *Biological Sciences*,
Dept. of Zoology, O. S. U., Columbus
'31. ZWICK, DR. KARL G., *Medical Sciences*.....Doctors' Bldg., Cincinnati

REPORT OF FORTY-FIRST ANNUAL MEETING OF THE OHIO ACADEMY OF SCIENCE.

WILLIAM H. ALEXANDER,
Secretary

INTRODUCTORY.

The Forty-first Annual Meeting of THE OHIO ACADEMY OF SCIENCE took the form of a very delightful tri-state meeting, the Academies of Indiana and Kentucky joining enthusiastically with the Ohio Academy in a two-day gathering on the historic campus of old Miami University at Oxford, Ohio. The setting and atmosphere of Old Miami could scarcely be excelled for such a gathering. The reception was cordial, the provisions for the comfort of visitors ample and satisfying, and the many mechanical and other requirements of the various scientific sessions wonderfully anticipated and provided for by the several local committees under the general and able supervision of Prof. Arthur T. Evans.

The Ohio Academy, certainly the Section of Physical Sciences, was further honored by the presence and participation of many members of the Central Ohio Physics Club and of the Akron Physics Society. The Academy welcomes these organizations and views such affiliation with high favor, sincerely hoping it will become stronger and closer with the passing years.

Somewhat in the nature of an experiment, the program committee made a very commendable and successful effort to provide intellectual and social entertainment for Thursday arrivals. A field trip under the guidance of Prof. William H. Shideler of Miami University was arranged for the afternoon for all who arrived in time and an informal program consisting mainly of an illustrated address by Dr. F. O. Grover of Oberlin College on "Traces of Early Man in Western Europe" was provided for the evening following the dinner hour. After the lecture, a delightful social hour was spent in the spacious lounge room of Ogden Hall. This innovation seems to have met with considerable favor and ought in the future to be a real inducement to go early for old and new acquaintance's sake.

The first formal meeting of general interest was that of Friday morning when the three presidents of the participating academies were introduced and gave an address. President Foerste of the Ohio Academy spoke on the "Ancient Life of the Arctic," President Davis of the Indiana Academy, on "Points of Historical and Scientific Interest in Indiana," (illustrated); and President Payne of the Kentucky Academy on, "An Optimistic View of the Evolution of Sciences."

Following these scholarly addresses, came a second innovation introduced by the program committee, namely, the giving of a definite and exclusive time for members to visit and enjoy the exhibits and demonstrations provided by members, often at considerable expense of time and energy. This innovation met with general favor and many were the expressions of pleasure and surprise at the variety, the number and general excellence of this feature of the annual program, really known to many for the first time.

The next event of general interest was the annual banquet on Friday evening in Ogden Hall dining room, which proved to be something of a surprise, especially in the matter of attendance which came near overtaxing the dining hall facilities. More than 300 reservations were made and still they came. Following a very delicious repast, the occasion was taken in hand by Prof. Robert A. Hefner, of Oxford, who as toastmaster guided the post-prandial exercises in a very skillful, interesting manner. He first introduced President Upham, of Miami University, who in a most gracious manner extended words of welcome to the several participating organizations and then followed these with some very happy, helpful observations on "Removing Partition Walls." The toastmaster then introduced, beginning with Kentucky, the presidents of the three academies, also the president or representative of each of the physics clubs participating in the meeting, each of whom made response to the welcoming words of President Upham and added his bit of wit. Then followed several delightful musical selections by local talent and then some more talk on "L. O. K." (the Lord only knows) by Professor Dan Sullivan, of Miami University—anecdotes told in a rapid-fire fashion that kept the audience in a continuous uproar of laughter! The banquet was a great success despite the unexpected numbers.

A third innovation introduced by the program committee was the reduction to a minimum of the time given to the business and general scientific session, the emphasis being decidedly on the sectional programs and meetings. Only two business meetings, one of a half hour on Friday morning and the other of three-quarters of an hour on Saturday morning were held and but one general scientific session, namely, on Friday morning, lasting an hour and a half.

Judged by any of the usual standards, the second Oxford meeting was a gratifying success.

Minutes of the Business Meetings.

First Session: April 3, 1931.

The first business session of the Forty-first Annual Meeting of the Ohio Academy of Science was held in McGuffey Hall, room 210, and was called to order by President Foerste at 9:00 A. M., Friday, April 3, 1931, with a quorum present.

The President announced the following committee appointments:

Committee on Membership—Ralph V. Bangham, E. W. E. Schear and W. H. Shideler.

Committee on Resolution—J. Paul Visscher, E. H. Johnson and E. Lucy Braun.

Committee on Necrology—Clarence H. Kennedy and Edward S. Thomas.

The reports of the Secretary and Treasurer were then called for and read. The report of the Secretary was accepted and ordered filed. The report of the Treasurer was referred to the auditing committee. Both reports are published elsewhere in these proceedings.

The Academy then proceeded to the election of an Auditing Committee, resulting in the election of J. E. Hyde and E. L. Rice.

The election of a Nominating Committee was then called for but owing to lack of time and the further fact that this committee is not expected to report until next year, the Secretary suggested that the election be postponed until the next meeting and be taken up at the same time as the general election of officers. There being no objection the election was postponed as suggested.

New business was then called for. There being none the reports of standing committees were called for and read as follows:

For the *Executive Committee*, by the Secretary.

For the *Publications Committee*, by F. O. Grover, Chairman.

For the *Trustees of the Research Fund*, by Herbert Osborn, Chairman.

For the *Committee on State Parks and Conservation*, by Herbert Osborn, Chairman.

At this point (about 9:40 A. M.) the Secretary called attention to the fact that the business meeting had already transgressed upon the time of the sectional meetings and moved to adjourn to 8:45 A. M. Saturday, April 4, 1931. Motion carried.

Second Session: April 4, 1931.

The second or adjourned session of the Academy met as per adjournment at 8:45 A. M., April 4, 1931, again in room 210, McGuffey Hall and was promptly called to order by President Foerste, with a quorum present.

The first item of business was the report of the Library Committee, passed over at the first session owing to the absence of the chairman when called. The report was read by Mrs. Ethel M. Miller, chairman, and is printed in full elsewhere in this report. The services of Mrs. Miller as chairman of the Library Committee constitute one of the most outstanding features of the year's work. Her work deserves and is receiving the hearty commendation of the Academy.

Following the report of the Library Committee, reports of Standing Committees were read as follows:

For the *Committee on Election of Fellows*, by the Secretary.
For the *Membership Committee*, by Ralph V. Bangham, Chairman.
For the *Necrology Committee*, by Clarence H. Kennedy, Chairman.
For the *Special Committee on Junior Scientific Effort in Ohio*, by C. G. Shatzer, Chairman.
For the *Special Committee on the Academy's Relation to the Ohio Journal of Science*, by J. E. Hyde, its Secretary, at the request of E. L. Rice, Chairman.
For the *Committee on Nominations*, by Edward L. Rice, Chairman.

All the above reports were received, ordered filed and are published in full elsewhere in these proceedings.

The following names were then placed in nomination for the *Nominating Committee* to make a report a year hence, viz: For *Zoology*, Wencel J. Kostir; *Botany*, J. Hobart Hoskins; *Geology*, Frank J. Wright; *Medical Sciences*, Charles G. Rogers; *Psychology*, James P. Porter; *Physical Sciences*, L. W. Taylor.

There being no other nominations, a motion was duly made and agreed to that the Secretary cast a written ballot for the persons mentioned which was done and they were declared elected.

In connection with the report from the Committee on Junior Scientific Effort in Ohio, Chairman Shatzer pointed out some of the inherent difficulties of the task and further stated that the work could not be successfully prosecuted without incurring some expense and requested an appropriation of $50.00 for this work during the coming year. Upon motion, duly made and passed, the committee was authorized to expend a sum not to exceed $50.00 in the discharge of its duties during the ensuing year.

Following the report of Necrology Committee, Prof. James P. Porter read a telegram just received announcing the death this morning of Prof. A. P. Weiss, a member and former president of this Academy, and then moved that the following message be sent to the bereaved family, viz:

"Members of the Ohio Academy of Science in annual meeting assembled wish to express to you and your family their sincere sympathy in your present loss. As a former President of the Ohio Academy of Science and Vice-President of the Section of Psychology, as research worker, teacher and friendly associate, Doctor Weiss will long be remembered and respected."

Dr. L. W. Taylor, of Oberlin College, offered the following resolution which was unanimously agreed to:

"The Ohio Academy of Science expresses its regret that consideration of House Bill Number 276 has not been found advisable. The Academy endorses the humanitarian features of that bill which proposes to reduce the very serious and unnecessary suffering by animals caught in steel traps. The practicability of trapping fur-bearing animals by methods that will either kill quickly or will catch animals uninjured is a matter of common knowledge. But use of these more expensive traps cannot become common until the common steel trap is outlawed. For this reason the Ohio Academy favors legislation outlawing the steel trap."

The selection of the Academy representative on the Council of the American Association for the Advancement of Science and the State Academies Conference, the selection of the next place of meeting and time, and the election of two representatives on the Save Outdoor Ohio Council were referred to the Executive Committee with power.

At 9:35 A. M. the business session was adjourned *sine die*.

SUPPLEMENTAL TO THE MINUTES OF THE BUSINESS SESSIONS.

Important Miscellaneous Notes.

1. From the *Executive Committee:* At the final meeting of the Executive Committee, Dr. Edward L. Rice, a member of the committee, raised the question as to why it would not be advantageous to the Academy to select as the *Nominating Committee* for the ensuing year the vice-presidents of the current year, thus utilizing the experience and knowledge gained by the year's service as vice-presidents. The suggestion was favorably received by the Executive Committee and was passed on to the present Nominating Committee which, as may be observed, approved and followed the suggestion. The Executive Committee, of course, recognizes that it has no authority to place limitations on the Academy in the matter of electing its officers and committeemen, nor has it any desire to do so. The suggestion of Doctor Rice is simply placed on record for future reference.

2. From the *Committee on the Election of Fellows:* On account of last-minute nominations, resulting in hasty and sometimes premature action on the part of the committee, the committee, at the suggestion of Dr. F. C. Waite, put itself on record as follows:

"That the secretary be requested to prepare new blanks on which to make nominations to Fellowship and that it be definitely stated on the new blanks that all nominations to Fellowship must be in the hands of the Secretary at least 60 days before the Annual Meeting at which the nominations are to be voted on; and further, that the new blanks provide space in which to enter the societies of which the nominee is a member and how long a member of each."

Members submitting nominations to Fellowship hereafter will do well to note and follow the policy above outlined.

3. From *President Davis, Indiana:*

DEAR MR. ALEXANDER:

It was necessary for me to leave before noon last Saturday and consequently I did not have a chance to see you personally and express my appreciation as well as that of the Academy for your kindness in inviting us to meet with you and for the very excellent facilities provided.

I am sure that everyone from Indiana appreciated this opportunity and had a very enjoyable and profitable meeting.

I hope that we may have you with us at our next annual meetings.

Very sincerely yours,

JAS. J. DAVIS, *President.*

Lafayette, Indiana, April 8, 1931.

4. From the *American Ornithologists' Union:* An invitation to all members of the Ohio Academy of Science to attend the 49th States Meeting of the American Ornithologists' Union,

in the city of Detroit, during the week of October 19, 1931. "A very attractive program is being arranged and one interesting feature is a visit to Jack Miner's Bird Sanctuary, near Kingsville, Ont."

REPORTS.

Report of the Secretary.

OXFORD, OHIO, April 3, 1931.

To the Ohio Academy of Science:

Obviously an extended, detailed report by the secretary at this time would be quite out of order, owing to the severe time limitation placed upon the business sessions by the program committee. Perhaps additional details can be added to the printed report.

The usual and then some routine work of the office has been cared for as promptly and as efficiently as possible under the conditions. The service, to be sure, has not been perfect or above criticism, perhaps, but was the best we could do under the circumstances.

The Academy has grown, gathered strength, and now comes "rejoicing, bringing in the sheaves" of worthy accomplishments from the various fields of scientific endeavor, as abundantly demonstrated by the rich, varied programs before you.

We now have a total membership of 663, of whom some 89 are non-resident in Ohio, 5 being in foreign lands; 162 have been given the rank of *Fellow*, and 272 are known to be members of the American Association for the Advancement of Science (A. A. A. S.).

As the duly accredited delegate, the secretary attended all the sessions of the Council and the Conference of State Academies of the A. A. A. S. at Cleveland, Ohio, last December and participated as far as possible in the discussions that came before those bodies. We were very glad to nominate and see elected to the office of secretary of the Conference of State Academies a member of this Academy, Mr. S. W. Bilsing, now of Texas. Under the rule, this means his advancement next December to the office of President of the Conference.

One item of discussion before the Conference of State Academies was the matter of exchanges, "how to get them and what periodicals are available and desirable as exchanges." We presented with very considerable pride a detailed statement by Mrs. Ethel M. Miller, chairman of our Library Committee, on this matter, and feel that same was a very substantial contribution to the discussion, so much so, in fact, that we feel justified in publishing most of her statement as a supplement to this report.

Respectfully submitted,

WILLIAM H. ALEXANDER, *Secretary.*

Supplemental to the Secretary's Report.

THE PUBLICATIONS AND EXCHANGES OF THE OHIO ACADEMY OF SCIENCE.

By MRS. ETHEL M. MILLER, *Librarian.*

The Ohio Academy of Science was organized December 31, 1891, with 59 charter members, and was incorporated March 12, 1892.

It must have received periodicals in exchange within the next few years, for we find that at its tenth annual meeting, December 26, 1900, the Trustees reported that as the Academy was coming into possession, by exchange, of many valuable reports, monographs and other papers and as it was necessary that these be kept in some proper place where they could be as accessible to the members as possible, W. C. Mills had been appointed librarian. In December, 1905, he reported that exchanges were received from 26 scientific societies and colleges. In 1909, Mr. Mills reported that the publications of the Academy were being sent to the following exchanges: Academy of Natural Sciences of Philadelphia, Brooklyn Institute of Arts and Sciences, Buffalo Society of Natural Sciences, Connecticut Academy of Arts and Sciences, Cincinnati Society of Natural History, Denison University Scientific Laboratories, Davenport Academy of Sciences, Illinois State Laboratory of Natural History, Kansas Academy of Science, New York Botanical Garden, University of California, Wisconsin Academy of Sciences, Arts and Letters, University of Missouri, Missouri Botanical Garden, Chicago Academy of Sciences, Buenos Aires National Museum, and the British Museum. These places were sending publications which he was shelving in the library of the Ohio State Archaeological and Historical Society. By 1911 the library had grown to such an extent that the librarian was authorized by the Academy to purchase cards for cataloging the library and also to publish the catalog. In 1915 the library of the Academy was deposited in the Ohio State University Library. It is available to the entire university and the members of the Ohio Academy of Science are in turn privileged to use any of the books in the University Library.

In 1915 or 1916, the Biological Club of the University gave to the University Library all the exchanges that had been received by the Ohio Naturalist from 1900 to 1915.

It is not known positively how the early exchanges were secured, but it is assumed that it was done in the same way that it is being done at present, either offered voluntarily by the other party to the exchange or sought for by us. Many letters are received, especially from foreign countries, offering their publications in return for ours, the Proceedings of the Academy, the Ohio Journal of Science, or both. On the other hand, when we learn of some publication that we do not have or when our students, particularly the graduate students, have references to periodicals that we do not have, and we think there might be a possibility of securing them by exchange, the offer is made from here to exchange. In nearly every instance the offer is accepted, just as we usually accept offers that are made to us. Oftentimes the various societies and academies publish lists of their exchanges in an issue of

their publications. This is especially true of societies in Europe and South America. These make good lists to use in order to secure additional exchanges. The recently published Union List of Serials is exceedingly helpful. Our most recent find in it was the Knox Academy of Science, which publishes the Maine Naturalist. As a result, a set of the Maine Naturalist will soon be sent to us on exchange. Very frequently the value of the publication received is much more than that of the one we send, for instance, the Philippine Journal of Science, the Journal of the Marine Biological Laboratory of the United Kingdom, the books of the British Museum, etc. On the other hand, some are priced at a lower figure than ours, so that on the whole it keeps about even. We do not aim to keep it upon a monetary basis, but this is mentioned to show that exchanges of higher value can be secured.

For our own purposes we like to know the approximate value of our exchanges to show that the University is receiving in exchanges the equivalent of the $1,000.00 it gives annually to the Ohio Journal of Science and to show that the Ohio Academy of Science is presenting to the University Library a good return for what the Library expends for postage in sending the Proceedings to the members of the Academy and to the exchanges each year and in sending back volumes on exchange. The Academy exchanges amount to about $200.00 each year and the postage, and the freight on shipments to Washington for the International Exchange Service through the Smithsonian Institution will amount to between $50.00 and $60.00. In addition, the Library pays for binding the volumes of the exchanges, usually from $2.25 to $2.50 per volume. It is also worth a good deal to have the exchanges given proper housing and care.

Available periodicals.—Those are especially available that are published by universities, institutions, scientific societies, academies, museums, and the like, particularly if they maintain libraries or are connected with institutions where they can deposit what they receive in exchange.

Desirable exchanges.—The publications of those just cited above would be especially desirable. Last year's resolution that each Academy send its publications to all the others in this country is very good for each one would certainly wish to exchange with all of them. Our own Academy has now completed arrangements to exchange with all, the Knox Academy of Science, mentioned above, and the New Hampshire Academy being the latest, unless of course there are some others that we do not know about. The New Hampshire Academy of Science plans to begin publication fairly soon and will then send to us. Some places send books instead of periodicals, as the British Museum and Cambridge University. The latter waits a number of years and then send books up to the value of the accumulated subscription price for those years. Twenty dollars' worth of books were received in 1926. In a few more years it will be suggested from here that they send another shipment to us.

The desirability of the exchanges would likely be determined by the kind of place where they were deposited. As the Ohio Academy of Science deposits in a large State University practically everything is

desired and it is fitting that many things that would not be used a great deal should be shelved in our library rather than in the smaller libraries of the other universities and colleges in the State.

Relation of the Ohio Academy of Science to the Ohio Naturalist and to the Ohio Journal of Science. In November, 1900, the first issue of the Ohio Naturalist was published. As it was sponsored by men who were all members of the Ohio Academy of Science it was very natural that the Academy should adopt the Ohio Naturalist as its official organ. This was done in 1903. In 1914, the scope of the Naturalist was enlarged in view of the recently formed section of Physics in the Academy and the possible addition of other sections outside of natural science and also in view of the recent organization of the Ohio Biological Survey. The title was changed to the "Ohio Naturalist and the Ohio Journal of Science," and a year later the words "Ohio Naturalist" were dropped, retaining the last half of the new title. The Naturalist agreed to publish announcements of the meetings of the Academy, lists of publications for sale, etc., whenever the Academy desired, but such matter might be restricted to one-half page in any one issue. However, for years now the Journal has given a full page. Papers presented at the annual meetings of the Academy of from 300 to 1,500 words will be printed and the address of the President will be published in the Journal. The Journal, as was the Naturalist, is sent without additional cost to each member of the Academy not in arrears for dues. The Academy is represented on the Editorial Board of the Journal, for a time by the members of the publication committee, then by a member from each one of the various sections, but since 1926 by the retiring President and current year's President.

The Academy has always paid at least half the dues of each member to the support of the Journal, increasing from 50 cents in 1903 to 75 cents in 1906, to $1.00 in 1919, the dues increasing correspondingly, and in 1927 it decided to give $1.50 to the Journal from its dues of $2.50.

Report of the Treasurer.

(See report of the Auditing Committee.)

Report of the Executive Committee.

OXFORD, OHIO, April 3, 1931.

To the Ohio Academy of Science:

During the past year the Executive Committee has met four times—twice as an executive committee and twice in joint meeting with the vice-presidents, all members of the committee being present at all four meetings.

At the first executive committee meeting, held on November 15, 1930, in the office of the secretary, the time and place of the 1931 annual meeting were decided upon and definite plans inaugurated. The happy suggestion that this meeting be made a joint meeting of the Indiana, Kentucky and Ohio academies met with instant and unanimous favor and action was authorized accordingly. The results are before you.

Other items, perhaps of general interest, transacted at this meeting were:

1. That the Academy take two memberships at $12.00 each in the "Save Outdoor Ohio" Society, whereupon Mr. S. Prentiss Baldwin, of Cleveland, and Dr. E. Lucy Braun were elected to represent the Academy in this organization, with Dr. Herbert Osborn, Ohio State University, and Dr. A. E. Waller, same institution, as alternates. Mr. Baldwin later declined with regrets to serve, owing to lack of time and press of other work.

2. The Secretary was elected the official delegate on the Council of the A. A. A. S. and the Conference of State Academies.

3. The Publications Committee was requested to make report on the advisability and feasibility of re-publishing Lynds Jones' "Birds of Ohio."

The *second meeting* was held on February 7, 1931, in Parlor G, The Deshler-Wallick Hotel, Columbus, and was a joint meeting with the vice-presidents of the Academy. We also had with us, by invitation, Dr. N. E. Pearson, of Butler University, chairman of the Program Committee of the Indiana Academy, and Prof. Arthur T. Evans, Miami University, chairman of the Local Executive Committee at Oxford.

The main purpose of this joint meeting was, of course, a thorough survey and discussion of the many and various details involved in a tri-state gathering of the "wise men and women" of the three academies. After about two and one-half hours of earnest, frank discussion, practically all details were agreed upon and a provisional program prepared for the Preliminary Announcement of the annual meeting. The entire joint committee was pleased with the detailed set-up reported by Professor Evans for taking care of the meeting at Oxford.

The *third meeting* was also a joint meeting with the vice-presidents and was held last evening in Ogden Hall and was for the purpose of passing on nominations to Fellowship in the Academy. All members were present.

Following the adjournment of this joint meeting, the Executive Committee met in its fourth and final session of the year. The secretary laid before the committee the applications of some 57 persons for membership in the Academy and as they were in regular form and dues paid, it was unanimously voted to recommend their election to membership.

(See Note 1, under Important Miscellaneous Notes.)

Respectfully submitted,

WILLIAM H. ALEXANDER, *Secretary.*

Report of the Publications Committee.

OXFORD, OHIO, April 4, 1931.

To the Academy of Science:

The Annual Report of the Fortieth Meeting, Proceedings, Vol. VIII, Part 7, containing 107 pages, was published August 28, 1930.

With this was published the title page and table of contents of Vol. VIII of the Proceedings, consisting of the Annual Reports of the Thirty-sixth to Fortieth meetings, 1926–1930.

Respectfully submitted,

F. O. GROVER, *Chairman.*

Report of the Trustees of the Research Fund.

COLUMBUS, OHIO, March 31, 1931.

To the Ohio Academy of Science:

The following condensed statement of the Research Fund shows that we have made grants to the extent of $73.55, which, with interest additions during the year, leaves a free balance in the bank subject to check of $150.86.

SUMMARY OF ACCOUNT FOR 1930-31.

RECEIPTS.

Balance in checking account, April 18, 1930	$ 166.91
Receipt from interest	57.50
Total	$ 224.41

EXPENDITURES.

Grants to research projects	$ 73.55
Balance in checking account April 1, 1931	$ 150.86

SUMMARY OF ASSETS.

Invested Funds—	
Bonds	$1,300.00
Bank certificates	300.00
Balance in checking account	150.86
Total resources	$1,750.86

It should be noted that our meeting is earlier in April than last year and interest payments due during the month will add to our cash balance. This will make possible further grants or an addition to the invested funds.

Respectfully submitted,

(Signed) HERBERT OSBORN,
L. B. WALTON,
Trustees.

Report of the Library Committee.

COLUMBUS, OHIO, April 2, 1931.

To the Ohio Academy of Science:

The past year has been a rather uneventful one as regards the work of the Library Committee. The Proceedings of the 40th meeting of the Ohio Academy of Science were received in September, 1930, and 704 copies were posted to the members of the Academy, to the exchanges, and to those institutions maintaining standing orders. There was left a surplus stock of 290 copies.

Four new exchanges were secured, making a total of 133. At the last meeting of the Ohio Academy of Science there was handed to the Chairman of this Committee a copy of a resolution adopted at the meeting of the various State Academies held in connection with the A. A. A. S. meetings at Des Moines in 1929. It proposed that each Academy send its publications to every other Academy in this country. As far as is known, twenty-four States and nine cities maintain Academies and one State has two. However, there may be more, for it was only last week that information was received concerning a new one, the Peoria Academy of Science. Negotiations are now being made concerning an exchange with it.

As regards the other Academies, the Ohio Academy of Science has arranged to exchange with all the State Academies and with all but one of the city Academies. No exchange has been offered, as its publication is purchased by our University Library. Some of the State Academies do not yet issue any publication, but assurance has been given that they will send them to us as soon as they do. These are not included in the number of exchanges as stated above.

Once each year and sometimes twice, a shipment of our publications is made ready to go to the exchanges in foreign countries. The first shipment for this year will be sent within the next few weeks.

The mailing list of the members of the Academy has been kept as carefully as possible. Sometimes the changes in addresses are not sent by the members and the information, if received at all, comes in various ways. It is always appreciated when official notification is received directly from the member making the change in residence.

The sales of publications have amounted to $89.40. This is the largest amount ever sold in any one year and is due to a recent order for a complete set of the Ohio Academy of Science Proceedings. It came from a library and will likely be followed by a standing order for each year's issues. An examination of the sales shows that 166 items were sold in 56 sales. These items consisted of 70 Annual Reports and 96 Special Papers. Three of the Academy members purchased Reports to complete their files of the Proceedings. It is hoped that more of our members will adopt this practice and thus secure complete sets for themselves and increase the sales for the Academy.

One or more copies of all the Special Papers were sold, showing that the demand for them comes from people interested in all the various fields represented by these Papers. At the meeting last year it was recommended that no more copies of Dr. Osburn's "Fishes of Ohio" be sold in separate sales, as the stock had become reduced to 25 copies. However, when the inventory was taken, an additional package containing 43 copies was found, making such recommendation unnecessary. Judging from the number of copies sold, Max Morse's "Batrachians and Reptiles of Ohio" was the paper most in demand. Next was the one on "Preglacial Drainage of Ohio," followed closely by Dr. Osburn's "Fishes of Ohio," Sterki's "Land and Freshwater Mollusca of Ohio," and Miss Detmer's "Ecological Study of Buckeye Lake." Then came Dr. Kellicott's "Odonata of Ohio," followed by Prof. Hine's "Tabanidæ of Ohio," Prof. Moseley's "Flora of the Oak Openings,"

Dr. Stover's "Agaricaceæ of Ohio," and Dr. Grigg's "Willows of Ohio." All the other Papers followed in fairly close succession. Eighteen of these 56 sales were made to people in Columbus, 17 to those in other cities in our own State, and 21 to persons residing in nine different States, Washington, D. C., and Ontario, Canada. The nine States extended from Massachusetts to California and from Minnesota to Tennessee.

The following financial report is submitted:

RECEIPTS.

Cash balance on hand April 18, 1930	$ 96.32
Collected on 1929–1930 sales	2.30
Sales for 1930–1931	89.40
Payment for Volume Ohio Journal of Science included in a check for Ohio Academy of Science publications	2.00
Bank dividends for 1930	3.12
Total receipts	$193.14

EXPENDITURES.

A. E. Waller, for sales, 1929–1930	$ 76.75
B. S. Meyer, for sale of volume Ohio Journal of Science	2.00
Total expenditures	$ 78.75
Cash balance on hand April 2, 1931	$ 83.49
Outstanding accounts	30.90
Expenditures, 1929–1930	78.75
Total	$193.14

SUMMARY OF ASSETS.

Sales for 1930–1931	$ 89.40
Accumulated bank dividends	24.99
Total balance	$114.39

Respectfully submitted,

ETHEL M. MILLER, *Chairman.*

Report of the Committee on State Parks and Conservation.

COLUMBUS, OHIO, March 31, 1931.

To the Ohio Academy of Science:

Your committee is pleased to be able to report considerable progress in activities for conservation and development of State Parks during the past year and also we hope that legislation now under consideration may give additional advantages in this line.

Your representatives on the "Save Outdoor Ohio" Council have co-operated in consideration of desired legislation and feel that this association is worth while and should be continued.

Among the items considered by the legislature is a bill to prevent depletion of clam beds in the streams of the state has been considered and recommended by the senate committee for passage and seems likely to be enacted into law. An anglers license bill has been under

consideration and also is recommended for passage by the senate committee. A bill for taking quail from the song-bird list has been killed and a bill termed the "Live trap bill," for fur-bearing animals, has been postponed indefinitely and seems unlikely to pass.

Another bill which prohibits the holding of nets within one mile of the Ohio river is considered an additional protection to the fishes in the tributaries of the Ohio river. A further bill providing for the taking over of state lands for state parks has, in substitute form, been recommended for passage. A bill which is of special interest to some of our members, providing for the building of bridge dams in connection with highway bridges, has been passed by the senate and is being considered by the house, having had its first reading last week. There appears to be no opposition and the bill seems likely to pass. If passed it will make it possible to provide reservoirs or slack water in streams and should do much to preserve native conditions for aquatic life.

Another bill providing for the regulation of outdoor advertising along the highways has been especially sponsored by the Council and supported by many organizations and is likely to pass and is of special interest in protection of scenic localities from desecration.

The State forests, which are of particular interest as reserves for biological interests, have been considerably increased in area and we may conveniently quote from a recent statement by the State Forester:

"The past biennium saw a big increase in State Forests and Forest Parks in Ohio. During that period two State Forests, the Hocking Experimental Forest and the Zaleski Forest, and two Forest Parks, the Mohican Park and the Virginia Kendall Park, were added to the growing list.

"The most recent of these additions is the Zaleski Forest, situated in eastern Vinton County and having an area of 3,400 acres. It is the first area purchased in this County, although Waterloo Forest, in Athens County, is only four miles to the eastward and the two may in time be organized as a single unit.

"Acquisition of additional tracts adjoining or located near already existing Forests and Forest Parks has nearly doubled the total land holdings. The biggest increase has been made in Shawnee Forest. Two years ago this Forest covered an area of 17,000 acres, while now the area has increased to 35,800 acres. Pike Forest has increased from 3,550 to 7,588 acres. The other State Forests have not been increased so much.

The Forest Parks have not increased as greatly as the Forests have in the past two years. The Hocking Series has increased from 2,000 to 2,832 acres, the Virginia Kendall Park of 400 acres has been obtained, the Mohican Park of 350 acres purchased and increased later to 850 acres, and the Hocking Experimental Forest of 608 acres purchased, all in the past biennium.

"The total holdings of the Forestry Department on February 1, 1931, comprise 59,206 acres. This includes the Wooster Arboretum and the Marietta Forest Nursery."

There have been no notable additions to the area of game refuges, but a new State Park near Mt. Gilead, in Morrow County, is of interest

as providing an attractive recreational park in a section of the state not otherwise supplied. If we recall the various holdings of the Archaeological and Historical Society, many of which are of biological and scenic interest, we can see that the state is gaining a considerable number of desirable tracts for forest conservation, wild life preservation, park and recreational purposes and that the movement is almost certain to gain momentum in the future. Taken altogether, we may feel encouraged in the outlook and continue the effort to convince the public of the value of these projects and the necessity for their proper administration.

Respectfully submitted,

HERBERT OSBORN, Chairman,
E. LUCY BRAUN,
J. E. CARMAN,
Committee.

Report of the Auditing Committee.

OXFORD, OHIO, April 4, 1931.

To the Ohio Academy of Science:

The Auditing Committee requests permission to report its audit of the Treasurer's report at a later date to the Executive Committee, in order to allow time to complete the records on some minor items.

The Committee has audited the accounts of the Board of Trustees of the Research Fund and finds them correct.

The Committee has audited the accounts of the Librarian of the Academy and finds them correct.

Respectfully submitted,

(Signed) EDWARD L. RICE,
J. E. HYDE,
Committee.

The report was accepted as read and the request of the Committee for further time in which to complete the audit of the Treasurer's books was granted.

Report of the Membership Committee.

OXFORD, OHIO, April 4, 1931.

To the Ohio Academy of Science:

Your committee recommends the election of the following persons to membership in the Academy whose applications in proper form are herewith and whose dues for one year have been paid:

ALDRICH, JOHN W., Cleveland.
ALTENBURG, JOHN D., Findlay.
ANDERSON, BERTIL G., Cleveland.
ATWOOD, HARRY, Columbus.
BACON, FRANKLIN J., Cleveland.
BAIRD, ROBT. L., Oberlin.
BEAN, L. G., Columbus.
BELLOWS, ROGER M., Columbus.
MILLER, EVERETT T., Columbus.
MUNN, LOTTIE E., Painesville.
NELSON, BELFORD B., Athens.
NETERER, INEZ, Painesville.
PATRICK, JAMES R., Athens.
PHEE, REV. MARTIN J., Cincinnati.
PIERSTORFF, A. L., Columbus.
RAUCH, R. P., Columbus.

BERLIN, LEONORE A., Painesville.
BOLE, B. P., JR., Cleveland.
BURRELL, CHARLENE M., Alliance.
CANTRALL, C. M., New Concord.
CONANT, ROGER, TOLEDO.
COTTRELL, CASPER L., Gambier.
DAVIS, B. M., Oxford.
DILLER, O. D., Columbus.
DODD, D. R., Columbus.
ELLIOTT, RUSH, Athens.
FOARD, CASTLE W., Youngstown.
FRAZIER, CHAS. H., Columbus.
FREELAND, RALPH O., Columbus.
GRIMM, WILBUR W., Oxford.
GROWDON, CLARENCE H., Columbus.
HALL, CLIFTON W., Columbus.
HERRICK, ERVIN M., Columbus.
HYRE, RUSSELL A., Columbus.
KALTER, LOUIS B., Dayton.
KIRK, W. J., Steubenville.
LEHMAN, HARVEY C., Athens.
LOCKETT, J. R., Columbus.
LUDWIG, WILLIAM B., Athens.
LUMLEY, FREDERICK H., Columbus.
MACLAURIN, DR. R. D., Cleveland.
MATHEWS, C. O., Delaware.
MATHEWSON, STANLEY B., Springfield.
REID, W. M., Circleville.
RIDDELL, NEWTON N., Lima.
ROACH, LEE S., Athens.
RIECKEN, WILLIAM E., Delaware.
SAWYER, DR. CARL W., Marion.
SCHAEFER, FRANCES, Columbus.
SCHOFF, C. N., Oberlin.
SCOTT, THURMAN C., Athens.
SHENKER, SAMUEL, Columbus.
SHARP, HENRY S., Granville.
SIMONTON, OWEN D., Wooster.
SLAVENS, MARGARET D., New Concord.
SMITH, PROF. J. J., New Concord.
STARK, ORTON K., Oxford.
SNYDER, LAWRENCE H., Columbus.
SQUIRES, G. R., South Euclid.
STEHR, WILLIAM C., Athens.
STETSON, HARLAN TRUE, Delaware.
STONE, ROBERT G., Columbus.
TAYLOR, DR. A. M., Painesville.
UHRBROCK, RICHARD S., Cincinnati.
VARVEL, CARL DUDLEY, Columbus.
WEIR, KENNETH J., Ashtabula.
WELCH, WINONA H., Greencastle, Ind.
WITHROW, ROBERT B., Cincinnati.
WOOD, C. C., Akron.
YOWELL, EVERETT I., Cincinnati.

Respectfully submitted,

RALPH V. BANGHAM, Chairman,
E. W. E. SCHEAR,
W. H. SHIDELER,
Committee.

Report of the Committee on Election of Fellows.

OXFORD, OHIO, April 4, 1931.

To the Ohio Academy of Science:

The Committee on the Election of Fellows has held but one meeting during the year, namely, on Thursday evening, April 2, 1931, at Ogden Hall, Miami University, Oxford, Ohio. All members were present. The following members whose nominations were in proper form and accompanied by satisfactory documentary evidence of the nominee's scientific achievements, received the required three-fourths vote of the committee and were declared elected to Fellowship, viz.:

E. WILLARD BERRY
HELEN JEAN BROWN
ARTHUR THOMPSON EVANS.
HOPE HIBBARD
CARL E. HOWE.
LOIS LAMPE.
H. C. SHETRONE
FORREST G. TUCKER.
CARL VER STEEG
E. B. WILLIAMSON
ORVILLE TURNER WILSON.

Respectfully submitted,

WILLIAM H. ALEXANDER, *Secretary.*

(See Note 2 under Important Miscellaneous Notes.)

Report of the Committee on Necrology.

For lack of time the committee was unable to prepare a suitable written report, but the Chairman, Dr. Clarence H. Kennedy, made an oral report, speaking at some length on the life and work of Professor James S. Hine, of Ohio State University, and a former president of this Academy. A full written report will probably be received in time to appear in these Proceedings.—W. H. A.

Report of the Committee on Junior Scientific Effort.

OXFORD, OHIO, April 4, 1931.

To the Ohio Academy of Science:

I. INTRODUCTORY REMARKS.

Your committee appointed at the last session to investigate the Academy of Sciences and high school practice and procedure in the encouragement of Junior scientific endeavor has carried on considerable correspondence and held personal conferences with the officials of other academies and individuals. The committee desires to report some progress in the accumulation of information and offer several recommendations.

II. MATTERS OF INFORMATION.

1. A number of state Academies are investigating the same problem.
   a. The Iowa Academy has just begun the fact-finding process.
   b. The Indiana Academy has made some progress.
   c. The Illinois Academy began the work in 1926. Organized the first of the high school units of the Junior Academy of Science in 1929 and now lists 18 high school clubs as members of a Junior Academy. They have an annual meeting of the Junior Academy which, under the direction of Miss McEvoy, of Rockford High School, is making fine progress in working out of the project.
2. Thirty-seven Ohio high schools listed by the North Central Association of Colleges and Secondary Schools were sent questionnaires by your committee. The Principals of the high schools were asked:

   Does your High School have a Science, Biology, Physics or Geography club? Who is the teacher in the mentioned departments? What is the name of the club and who is responsible for its direction?

   Thirty replies were received from the thirty-seven letters with the following results:

Biology Club	4
Biology and Zoology Club	1
Botany Club	1
Chemistry Club	5
Physics Club	5

Science Club..... 7
No Club..... 6
Blank–does not answer–probably no club. 4
Also some high schools have two clubs.

The promptness and number of the replies indicates interest.

3. A number of high school principals and instructors in science have been interviewed concerning the project. If care is exercised in approaching the school administrators and the instructors, their sympathetic co-operation can be secured in the project. Furthermore, neither the school officials nor more particularly the students must be permitted to develop a feeling that something is being handed down to them. If it does occur, the project will fail. Care must be exercised in building committees and the project must not be rushed or hurried, if it is to succeed.

III. Recommendations.

1. That a chairman be appointed to continue the committee work. That a committee include in its membership Prof. E. S. Vinal, of Western Reserve University School of Education; Mr. B. F. Fulks, of Norwood High School, Cincinnati, Ohio, and Miss Muriel Aberly, of Mansfield, Ohio, High School, provided she accepts the invitation. Prof. Vinal and Mr. Fulks have already indicated a willingness to aid in the committee work. Furthermore, the committee should be composed of:
   a. From university and college:
      A college administrator,
      A college teacher of science who is particularly interested in teaching of science,
      A college or university teacher who is capable of giving advice in the planning of research projects.
   b. From high school:
      A high school principal or superintendent. (Mr. Fulks has accepted.)
      A high school teacher in each of the following:
      Botany, Zoology or Biology; Physics, Geography.
2. That a maximum expenditure of $50.00 be voted this committee to carry on:
   a. Further investigation of the status and function of science clubs in the high schools. Paying the postage, mimeographing, etc., of such investigation.
   b. Preparing printed certificates of membership in a Junior Academy if it is found advisable.
   c. Keeping in touch with the work of other State Academies.
   d. Printing that may be necessary this year to interest the high school clubs.

Respectfully submitted,

C. G. Shatzer,
Chairman.

Report of the Special Committee on the Academy's Relation to the Ohio Journal of Science.

OXFORD, OHIO, April 4, 1931.

To the Ohio Academy of Science:

The committee recommends to the Ohio Academy of Science:

First. That it is desirable that the Ohio Journal of Science be published and controlled jointly by the Ohio Academy of Science and the Ohio State University.

Second. That the Ohio Academy of Science enter into such a relationship on the following conditions:

1. That the Ohio State University set up an agent that will be legally responsible for the University's interest in the Ohio Journal of Science.
2. That the Ohio State University, or its agent in the matter, agrees to the appointment of a joint Administrative Board for the Ohio Journal of Science. This Board shall consist of four members, two appointed by the Ohio Academy of Science from its membership outside the Ohio State University, and two by the Ohio State University or its agent.

   At time of establishment of this Board, one University member and one Academy member shall be appointed for two years, on nomination by the Nominating Committee of the Academy, and one each, for three years. Thereafter, appointments shall be for a term of three years and may be renewed on expiration.

   The Administration Board shall determine the editorial and business policies of the Ohio Journal of Science. It shall appoint the Editor, Business Manager, and such Editorial Staff as seems desirable. The Editor-in-Chief and Business Manager of the Ohio Journal of Science shall participate as non-voting members in the deliberations of the Administrative Board, except that in the event of a tie vote, the Editor-in-Chief may cast the deciding vote in all matters except that having to do with appointments to the positions of Editor-in-Chief and Business Manager. In the event of absence of one representative of either party to this agreement, proxy is given by this agreement to his colleague to vote for the absent member on all matters coming before the Committee.

   The Committee shall elect its Chairman and Secretary, shall keep records of its actions and transmit a report to the Academy at the annual meeting and to the agent for the Ohio State University. This report shall record important decisions and shall include the financial statement of the Ohio Journal of Science for the immediately preceding fiscal year of the Journal of Science.
3. That it will be mutually agreed by the Ohio Academy of Science and the Ohio State University, that this plan may be terminated on a year's notice by either party.

It further recommends:

That the present special committee on the Academy's Relation to the Ohio Journal of Science, jointly with the Publications Committee of the Academy, be charged with the negotiations with the Ohio State University looking to the adoption of the plan by the University.

That the President of the Academy fill the vacancies in the Special Committee on Publication Relations.

That the Secretary of the Academy place on file as a part of his records, the report on Publication Relations of the Ohio Academy of Science which was prepared by the Committee as a basis for its recommendations.

Submitted and signed by

EDWARD L. RICE, Chairman,
J. E. HYDE,
Committee.

Report of the Nominating Committee.

OXFORD, OHIO, April 4, 1931.

To the Ohio Academy of Science:

Your committee on nominations, elected a year ago, respectfully submits the following report:

President—ALPHEUS W. SMITH.

Vice-Presidents:

A. *Zoology*—J. PAUL VISSCHER.
B. *Botany*—ARTHUR T. EVANS.
C. *Geology*—EDMUND M. SPIEKER.
D. *Medical Science*—SHIRO TASHIRO.
E. *Psychology*—HORACE B. ENGLISH.
F. *Physical Sciences*—FORREST G. TUCKER.

Secretary—WILLIAM H. ALEXANDER.

Treasurer—A. E. WALLER.

Executive Committee—(Elective Members): A. F. FOERSTE and C. G. SHATZER.

Trustee, Research Fund—GEORGE D. HUBBARD.

Publications Committee—F. O. GROVER, F. C. BLAKE, E. L. MOSELEY.

Library Committee—L. B. WALTON.

Committee on State Parks and Conservation—HERBERT OSBORN, EDWARD S. THOMAS, W. E. STOUT.

Respectfully submitted,

EDWARD L. RICE, Chairman,
L. H. TIFFANY,
J. E. CARMAN,
R. J. SEYMOUR,
E. H. JOHNSON,
Committee.

At the conclusion of the reading of the report, the President called for nominations from the floor. There being none, a motion was made and duly seconded that the report be approved as read and that the persons named be the officer of the Academy for 1931–1932. Carried unanimously.

Report of the Committee on Resolutions.

OXFORD, OHIO, April 4, 1931.

To the Ohio Academy of Science:

The Committee on Resolutions beg leave to make the following report:

The Ohio Academy of Science expresses its very real appreciation of the courtesies extended by the various authorities and committees of Miami University for our unusually successful meeting and especially for the home-like atmosphere with which they have so happily surrounded us.

We wish further to express our appreciation for the stimulation brought to these meetings by the co-operating societies.

And we recommend that the secretary properly express this sentiment to those concerned and to inscribe these records as part of the minutes of this meeting.

Respectfully submitted,

PAUL S. VISSCHER, Chairman,
E. LUCY BRAUN,
E. H. JOHNSON,
Committee.

THE SCIENTIFIC SESSIONS.

GENERAL AND SECTIONAL.

The following is a complete list of the addresses and papers presented at the various general and sectional meetings of the Academy.

(Numbers in parentheses after the title refer to abstracts.)

1. Traces of early man in western Europe.....F. O. GROVER
2. Ancient life of the Arctic (Presidential Address).....A. F. FOERSTE
3. Points of historical and scientific interest in Indiana.....J. J. DAVIS
4. An optimistic view of the evolution of sciences.....V. F. PAYNE
5. Moving partition walls (Welcome Address).....PRESIDENT UPHAM
6. Micro-moving pictures of the circulation in living bird embryos, (1) BRADLEY M. PATTEN and T. C. KRAMER
7. Laboratory study of living birds (2).....S. PRENTISS BALDWIN
8. Regulation of body temperature in birds (3).....S. CHARLES KENDEIGH
9. Nesting success in a song sparrow population in 1930 (4)..MARGARET M. NICE
10. The heronries of northern Ohio (17).....E. L. MOSELEY
11. The dietary habits of barn owls in Ohio (6).....ARTHUR STUPKA
12. Some factors which limit or determine the distribution of some economic insects in the United States.....DWIGHT M. DELONG
13. Parasites of Buckeye Lake fish (7).....RALPH V. BANGHAM
14. A gilled oligochaete new to America: *Branchiura sowerbyi* in Buckeye Lake (8).....WARREN P. SPENCER
15. *Tanais cavolinii* Milne-Edwards (Crustacea) (9).....S. R. WILLIAMS
16. The development of the thoracic pleurites in the embryo of Conocephalus and its bearing on the ancestry of the insects and their allies..L. B. WALTON
17. The respiratory apparatus of *Parajulus impressus* Say (10).....R. A. HEFNER
18. Factors controlling the distribution of Cladocera in northern Ohio, J. PAUL VISSCHER
19. The recovery of a stream after pollution.....C. A. BARKER
20. Notes on the ecology of some grasshoppers of the genus Melanoplus (11), EDWARD S. THOMAS
21. The interpretation of the influence of environmental factors...L. L. HUBER
22. Some observations on the behavior of *Passalus cornutus* (Coleoptera) (12), WARREN C. MILLER
23. A limnological study of the Hocking River. (a) The plankton of the Hocking (13).....LEE STEWART ROACH
24. A limnological study of the Hocking River. (b) The bottom invertebrates of the Hocking (14).....WILLIAM B. LUDWIG
25. The embryology of the whitefish *Coregonus clupeaformis* (Mitchill) (15), JOHN W. PRICE
26. Histology of the intestinal tract of two minnows, *Notemigonus chrysoleucas* (Mitchill) and *Notropis atherinoides* (Rafinesque) (16), THOMAS SURRARRER
27. The morphology of the anterior autonomic nervous system of the earthworm (Lumbricus) (5).....C. C. ROGERS and T. T. CHEN
28. On the habits of Ohio reptiles in captivity.....ROGER CONANT
29. Skinning our parks (16a).....S. PRENTISS BALDWIN
30. The differentiation of shoddy in woolens by statistical methods, L. B. WALTON

[31. Preliminary report on the phototropic responses of *Drosophila hydei.* (Read by title) (10a)...WALTER S. WILDE, (Introduced by R. A. Hefner)
32. Is previous experience with plants related to the efficiency of freshman students in botany?.....O. T. WILSON
33. The Lemnaceae of Ohio.....LAWRENCE E. HICKS
34. Some poisonous plants indigenous to Indiana (18).....GEORGE W. FINLEY
35. A key to the commoner Ohio Hydnums.....W. G. STOVER
36. Some freshwater Algae of Southern Florida (19).....L. H. TIFFANY
37. Cleistogamy in Amphicarpon.....PAUL WEATHERWAX
38. Propagation of Equisetum from sterile aerial shoots....JOHN H. SCHAFFNER
39. Pollen analysis of Bacon Swamp, Indianapolis; evidences of two dry climatic periods in the post-Wisconsin (20), PAUL B. SEARS and A. E. WALLER
40. Barberry seed germination and seedling survival under natural conditions in Ohio.....W. G. STOVER and C. W. HORTON
41. Distribution of escaped common barberry in Ohio, C. W. HORTON and W. G. STOVER
42. The correlation between dry weather and the storage of organic reserves in alfalfa roots (21).....C. J. WILLARD
43. Concerning certain concepts of plant sociology.....STANLEY A. CAIN
44. Life forms of plant communities of the Cincinnati region, ALICE PHILLIPS
45. Precipitation, periodicity and natural vegetation.....E. N. TRANSEAU
46. Growth irregularities in hybrid Freesias induced by X-Rays..W. P. MORGAN
47. The physiological basis of cold resistance in evergreens..BERNARD S. MEYER
48. Absorption of water by root systems of plants (22).....PAUL J. KRAMER
49. New dyed cellophane filters for the investigation of the effects upon plants of the ultra-violet radiation at the limits of the sun's spectrum, ROBERT B. WITHROW
50. The loss in dry matter in sweet clover roots from fall to spring (23), C. J. WILLARD
51. The Gratz division of the Cynthiana series of Central Kentucky (24), J. J. WOLFORD
52. The Devonian corals of Ohio (25).....GRACE A. STEWART
53. A further report on the section at Hamburg, Ind.....W. H. SHIDELER
54. The horizon of the Brassfield limestone in southeastern Ohio (26), JAMES W. CUMMINS
55. Origin of limestone caverns (27).....A. C. SWINNERTON
56. Recent formation of dolomite in an Ohio Cave (28).....RICHARD C. LORD
57. Some temperature abnormalities in Indiana and Kentucky highs (29), ROBERT KENDALL and ERNEST RICE SMITH
58. The Finns in Ohio (30).....EUGENE VAN CLEEF
59. Erosion surfaces in eastern Ohio (31).....KARL VER STEEG
60. Some features of the surficial deposits of Licking County, Ohio, G. W. CONREY and A. H. PASCHALL
61. Paragenetic relations of galena and sphalerite (32).....RALPH TUCK
62. Brines of the deep-seated rocks.....WILBER STOUT
63. The subsurface in eastern Kentucky.....LUCIEN BECKNER
64. Announcement of plans for the annual spring field trip (33)..FRANK J. WRIGHT
65. A remarkable fossiliferous lens in the Bainbridge limestone of Missouri (34), PAUL H. DUNN

65a. The Foraminifera of the Bainbridge (35).....PAUL H. DUNN

66. Pre-Mesozoic stratigraphy of the central Wasatch mountains (36), A. A. L. MATHEWS

67. The earliest known Cephalopods of America, Europe and Asia, (37) AUG. F. FOERSTE
68. The status of paleobotany in Ohio (38).....WILLARD BERRY
69. The footprints from the Pennsylvanian (39).....ROBERT H. MITCHELL
70. Structural geology of northern and central Kentucky.....W. R. JILLSON
71. Is orogenic deformation continuous or discontinuous for the earth as a whole? (40).....WALTER H. BUCHER
72. A comparison of the Maine and Connecticut shorelines (41).HENRY S. SHARP
73. Industrial adjustments in the Miami valley (42).....A. J. WRIGHT
74. Summer rainfall of 1930: A relative representation (43).....R. B. FROST
75. Geology of the vicinity of Ticonderoga, N. Y. (44).....A. C. SWINNERTON
76. The hypsometric map versus the projected profile method in portraying and determining erosion levels. (To be read by title)(45)..KARL VER STEEG
77. Late Paleozoic and early Mesozoic Pugnoides. (To be read by title), A. A. L. MATHEWS
78. Some variations in muscular efficiency (46).....WALTER C. MCNELLY
79. Oxygen pulse under hypnosis (47).....B. M. DAVIS
80. Health habits of university women (48).....MRS. NORMA SELBERT
81. Studies on the basal metabolism of college students (49), C. G. ROGERS and R. L. KROC
82. Silicosis in Ohio industries (50).....B. E. NEISWANDER
83. The status of dental hygiene (51).....LONZO G. BEAN
84. The blood pressure of the opossum (52).....HOWARD E. HAMLIN
85. Further studies on experimental gastric ulcer (53), SHIRO TASHIRO and L. H. SCHMIDT
86. Physical treatment of behavior difficulties.....EDNA R. LOTZ
87. Anti-anemic influence of dessicated hog stomach.....A. B. BROWER
88. Science versus crime.....HERBERT S. MIKESELL
89. Adequate emotional stimuli and the psychogalvanic experiment, B. B. NELSON and JAMES P. PORTER
90. The effect of cinchophen on the liver of white rats, L. B. NICE, R. M. KNOBLE and H. A. SMITH
91. Sex-character education through pets. (An experiment with children at the Nature Guide School, Western Reserve University) (54), WILLIAM G. VINAL
92. Orientation of white rat on elevated maze.....EDWARD NEWBURY
93. The effect of emotional stimuli on the activity of the white rat, JAMES R. PATRICK
94. Some recent findings in the part and whole methods of learning, C. C. WOOD
95. A comparison of the high relief finger maze and improved form of the stylus maze.....T. C. SCOTT
96. Influence of grouping on serial learning of multiple choice...F. H. LUMLEY
97. Experimental evaluation lecture: Quiz versus recitation method in teaching elementary Psychology.....H. H. REMMERS
98. An objective study of student and faculty attitudes toward academic honesty.....G. O. MATHEWS
99. Some attitudes related to intelligence.....GORDON HENDRICKSON
100. A diagnostic technique for studying social and emotional adjustment (55), O. A. OHMANN
101. The selection of indices of "Progress" of Ohio Counties.....G. W. HALL
102. The mental status of reformatory women.....C. H. GROWDON
103. How scientists differ in reporting their church affiliations in "Who's Who".....H. C. LEHMAN

104. Rating scales in industry.....R. S. UHRBROCK
105. The effect of hypnosis on long delayed recall.....J. M. STALNAKER
106. The effect of rhythm and reverie on the machine worker,
STANLEY B. MATHIEWSON
107. Visualizing molecular encounters by means of models.....H. P. KNAUSS
108. The lecture-demonstration and individual laboratory methods of introducing college students to first year chemistry,
C. C. Ross and V. F. PAYNE
109. Some ideas about sound that are not sound.....ARTHUR L. FOLEY
110. Note on the change of the upper frequency limit of audition with increasing age.....L. W. TAYLOR
111. Equilibrium conditions in stars.....H. M. ROTH
112. The present-day picture of cosmic change.....L. H. THOMAS
113. A photometric study of the appearance of the spectral lines in a condensed discharge.....H. V. KNORR
114. Wave-length measurements in the Schumann region,
D. S. MARSTON and R. V. ZUMSTEIN
115. The absolute measurement of X-rays of long wave-length by reflection from a ruled grating.....CARL E. HOWE
116. Efficiency of characteristic X-rays.....D. BERKEY
117. Comments on the nature of X-ray absorption and scattering..S. J. ALLEN
118. Cold emission from unconditioned surfaces.....WILLARD H. BENNETT
119. Effect of low speed electrons on bacteria.....D. A. WELLS
120. A study of some electrical phenomena by means of the cathode ray oscillograph.....RICHARD H. HOWE
121. Potential gradient and space charge in atmospheric electricity,
C. H. DWIGHT
122. Some fundamental experiments on side-bands.....R. R. RAMSEY
123. Television, yesterday, today, and tomorrow.....R. B. ABBOTT
124. Organization of Physics and Physicists in Ohio. Remarks by the Retiring President.....C. W. JARVIS
125. Vibrations in a wire carrying an electric current.....R. SCHAFFERT
126. A null electrical method for the measurement of magnetic field intensities,
R. L. EDWARDS and W. C. DOD
127. Magnetic susceptibilities of binary alloys.....F. L. MEARA
128. Galvanomagnetic and thermomagnetic effects in permalloy and Perminvar.....A. R. FOUTS
129. A lecture-demonstration of the Bernoulli principle.....S. J. M. ALLEN
130. A determination of the déelectric constants and deusilies of bromo-benzene—nexane solutions and the determination of the electric movment of the bromo-benzene molecule (56).....LOUIS M. HEIL

DEMONSTRATIONS AND EXHIBITS.

1. The technique used in determining human blood groups.....L. H. SNYDER
2. The common barberry with charts and specimens,
WAYNE F. LEER and HARRY ATWOOD
3. New Psychogalvanic Apparatus.....B. B. NELSON and JAMES P. PORTER
4. The distribution of Alleghenian species of amphibians in Ohio,
CHARLES F. WALKER
5. Charts and photographs illustrating the dietary habits of barn owls in Ohio.....ARTHUR STUPKA
6. Persistent first premolar teeth in the horse,
JAMES E. MILLER. (Introduced by R. A. Hefner)
7. A plankton bottle.....LEE STEWART ROACH
8. Drawings of Ohio Ants.....CLARENCE H. KENNEDY
9. Orthoptera not hitherto reported from Ohio.....EDWARD S. THOMAS
10. Ohio species of Melanoplus.....EDWARD S. THOMAS
11. American species in horticulture.....H. H. M. BOWMAN

PRESIDENTIAL ADDRESS

ANCIENT LIFE OF THE ARCTIC

AUG. F. FOERSTE.

Former ideas of the origin of the earth and of the life upon it were conditioned by our belief in the Laplace theory. According to this theory, the earth, as well as the remainder of the solar system, originally was part of an enormous rotating mass of gas, which later cooled to a liquid state, and finally, in the case of the earth, was covered by a solid crust. The atmosphere surrounding the earth, according to this theory, originally was very hot, and only gradually cooled to the much lower temperatures known under modern conditions. Life was supposed to have begun, while the atmosphere still was hot, or at least very warm. Former climates were supposed to have been not only warm, but nearly uniform around the entire earth; in other words, about as warm in polar areas as at the equator. To account for such an anomalous distribution of climates, the atmosphere of those ancient times was supposed to have received its heat chiefly from the interior of the earth, and not from a source exterior to the earth, namely, the sun. The rapid loss of the heat of the earth's atmosphere by radiation was supposed to have been prevented in large part by an abundance of heat absorbing gases, chiefly moisture and carbon dioxide, in this atmosphere. The control of the climate of the earth by an outside agency, the sun, rather than by an inside source, the heat of the interior of the earth, was supposed to have originated relatively recently, geologically speaking, some placing the time at which this change of control took place even as late as the Upper Tertiary. From this point of view, therefore, former climates, with their uniformly warm conditions over the entire surface of the earth, and their absence of climatic zones, differed greatly from the strongly contrasting climates existing at present.

According to the Laplace theory, therefore, the oldest rocks on the surface of the earth were formed under conditions of great heat. This opinion, for many years, appeared confirmed by the fact that, all over the surface of the earth, the

oldest or Archaean rocks are crystalline, consisting of granites, gneisses and schists, supposed to have been produced under the influence of great heat. Recently, however, it has been discovered that in Finland these schists of Archaean age show evidences of cross-bedding, and that at various horizons they even contain distinct layers of conglomerate. Add to this the fact that at various localities these schists are interbeded with quartzite and various kinds of calcareous rocks, and the evidence becomes clear that Archaean rocks were deposited not under the influence of great heat, but under that of running water. Further study has shown, moreover, that the granites of the Archaean are not older than the schists, but younger, being intrusive into the latter. In other words, the schists originally were of sedimentary origin, but later became crystalline, under the influence of regional metamorphism induced by enormous masses of intruding granite.

However, unquestionably the greatest blow to our former belief in the igneous origin of Archaean rocks was that administered by the more recent discovery that, in the Huronian, conditions in certain northern areas were distinctly glacial; in other words, the exact opposite of igneous. During the Huronian, for instance, glacial tillites or clays extended from northern Wisconsin across southern Canada to the area southeast of the southern extension of Hudson Bay, a total east and west extension of 800 miles. At Cobalt, 330 miles directly north of Toronto, this tillite contains glacially striated boulders. Near Opazatica lake, 50 miles north of Cobalt, the glacial tillite rests on flat surfaces of older rock marked by Glacial scratches running N. 60° E. Glacial scratches occur also on the surface of the rocks beneath the Huronian glacial tillites at Matachewan, 100 miles northwest of Cobalt. Similar conditions, namely glacial tillites containing scratched boulders and resting on smoothed rock surfaces also showing glacial scratches, are known also at Varangerfjord, immediately east of the extreme northern end of Norway, in strata formerly regarded as of Lower Cambrian age, but at present regarded as possibly Pre-cambrian. Glacial conditions are cited also from the Pre-cambrian in Spitzbergen, about 600 miles north of Norway, and at the mouth of the Lena river, in Siberia. These areas are sufficiently circumpolar in their distribution to suggest cold, rather than hot climates, throughout the entire polar region at the northern end of the earth.

Following Pre-cambrian times, no wide-spread glacial conditions are known until near the close of the Paleozoic epoch, during the so-called Permo-carboniferous. During this period glacial tillite, containing striated pebbles, was wide-spread in India, in both eastern and western Australia, and near the southern end of Africa. This again is a circumpolar distribution, but around the southern pole of the earth.

The last wide spread glaciation of the world again is a northern one, that of Pleistocene age, familiar to all of us, and well exhibited in our own area.

Evidently, life did not begin under the influence of hot, or at least very warm atmospheres, gradually ameliorating to those contrasts of climatic zoning which now surround us.

The question arises, how did the belief originate that certain polar areas formerly existed under tropical conditions? The basis for this belief certainly was meager and not reliable. Along the middle of the west coast of Greenland there are about 20 exposures of Eocene strata from which 282 so-called species of plants have been identified, chiefly based on leaves of trees, but including also numerous flowers and fruits. Among these leaves there are two species of monocotyledonous plants which resembled those of palms, and which were described as species of Flabellaria. However, more exact study of these leaves have by no means served to definitely confirm their identification as palms. On the contrary, all of the numerous associated species of tree and shrub life, such as the willows, poplars, birches, and hazels, indicate cool temperate climates, and not tropical conditions. Absence of tropical conditions is indicated also by the presence of leaves of alders, beech, oaks, elms, sassafras, sycamore, ash, dogwood, tulip tree, maple, and sweet gum, which possibly indicate a warmer climate than that suggested by the trees cited first, but certainly nothing warmer than warm temperate, and under no circumstances anything as warm as tropical, or even subtropical. This prevalence of leaves of willows, poplars, birches, and hazels is not confined to the Eocene of west Greenland, but occurs also in the Eocene of Iceland, Spitzbergen, Novaya Zemblya, Siberia, and S. E. Alaska. In other words, during the Eocene, this cool temperate tree flora was circumpolar in distribution.

Smilar evidence, at first sight also of conflicting character, is presented by the tree flora of the middle part of western

Greenland during the Upper Cretaceous. In these strata there occurs a specimen of Artocarpus, the genus to which the tropical bread-fruit tree of modern times belongs. However, the abundant associated flora is preponderatingly of a temperate climate character. Berry, the paleobotanist, very pertinently asks whether more weight should be given to a single species suggesting tropical conditions, or to numerous species all indicating temperate climates? Evidently the answer desired is that in favor of the preponderating evidence, the one in favor of a temperate climate.

Prior to the Middle Cretaceous the plant life of the earth was so different in character from that existing at the present time that it is difficult to arrive at any definite conclusions regarding the climatic conditions existing then. However, the presence of seasonal growth rings in the fossil woods of Lower Cretaceous and of earlier age suggests that there were at least changes corresponding to our alternations of summer and winter. Moreover, such seasonal rings are characteristic rather of trees growing in temperate zones than of those living in the tropics. For instance, one tree trunk, found in the Lower Cretaceous of King Charles' Island, east of the Spitzbergen group of islands, was found to retain 210 seasonal growth rings, although the outer part of this trunk evidently was not preserved. At a still earlier age, in the Jurassic of Spitzbergen, 9 kinds of coniferous woods were found which showed pronounced seasonal growth rings. During the Culm or Lower Carboniferous, corresponding in age to our American Mississippian, distinct seasonal growth rings were found in the gymnospermous tree trunks belonging to the genus Dadoxylon in Russia, in the province of Silesia in southeastern Prussia, and in the Vosges area of northeastern France. Although Dadoxylon occurs as early as the Devonian, seasonal growth rings appear unknown from strata of this age. This, however, must not be interpreted as indicating the absence of seasonal changes. Even during the Culm all species of Dadoxylon did not show growth rings.

Two things impress the student of ancient Artic tree floras. First, that, during Eocone and Cretaceous times, floras now characteristic of temperate climates at that time extended much farther north, occurring, in fact, in Greenland, Spitzbergen, and other Arctic lands, as already stated. Second, that temperate climate floras had a much greater north and south

geographical range. In other words, that climatic zoning was far less accentuated then than at present. Nevertheless, we are not without indications of climatic zoning even in the geologic past. For instance, Heer concluded from his study of the Eocene flora of Greenland that the climate of that area was distinctly cooler than that of the supposedly contemporaneous flora found in the Eocene of Switzerland. Moreover, according to Berry, the Jackson or Upper Eocene flora of the southern United States finds its nearest living relatives along the present Gulf coast, and therefore suggests a climate not only warmer than that of Greenland, but also that of Switzerland. Similar differences of climate are noted also along the Pacific coast of North America, where, according to Hollick, the Eocene flora of northern Alaska was distinctly cooler than the contemporaneous flora of S. E. Alaska, the latter containing cycads and palms. In fact, the climate of southeastern Alaska appears to have been considerably warmer than that at corresponding latitudes along the Atlantic coast. Seasonal climatic zones appear to have been present at least as early as the Lower Cretaceous, at which time, according to Gothan, the coniferous woods of King Charles land, east of Spitzbergen, showed more pronounced growth rings than those of the same age in central Europe. From this it may be assumed that climatic zoning was present at least as early as the Eocene, probably as early as the Lower Cretaceous, and possibly as early as the Culm or Lower Carboniferous, if the presence of seasonal growth rings in the trunks of trees can be regarded as indicative of temperate, rather tropical climatic conditions.

The distribution of life in the existing seas is exactly opposite to that on the land. The cold waters of the Arctic may contain a relatively smaller number of species, but these Arctic species are represented by a vastly greater number of individuals of each species, than is usual in tropical and subtropical areas. Johnstone, in his Study of the Ocean (1926, p. 138) states that in the sea animal life of all kinds, both in surface waters and on the sea bottom, is more dense in polar areas than it is in intertropical ones. Jenkins, in his Text-book of Oceanography (1921, p. 98) states that, generally speaking, the open oceans are less rich in plankton (floating sea life) than coastal waters; and, again, that tropical seas are poorer in animal life than colder waters, and that this difference is dependent directly

on the much greater amount of plant food found in Arctic waters.

All students of Arctic marine life have been struck by the great abundance of miscroscopic marine algæ, chiefly diatoms and the like. This remarkable abundance is favored by the cold temperature of Arctic marine waters. At cold temperatures, as is well known, water can absorb and retain a much larger volume of any gas. For the development of plant life this means carbon dioxide. It has also been stated that the denitrifying bacteria are far less common in cold waters than in warmer waters, thus insuring a more abundant supply of nitrogen for plant growth in Arctic seas.

Upon this abundant microscopic plant life feed the myriads and myriads of minute crustaceans and other minute marine animals, which in turn serve as food for successively larger animals until the giants of Arctic waters are reached, such as the whales, walrus, sea lion, the seals, numerous fish, and the less familiar invertebrate animals, including even the giant squid. In this connection we must not forget the extremely abundant bird life of the Arctic, almost entirely dependent for its food on the sea; in the last analysis, on the abundance of marine plant life.

Unfortunately, marine life, though far more abundantly represented in fossil form than terrestial plants, has so far not proved a dependable indicator of former climatic conditions. This has been emphasized recently by Kirk, in his paper on Fossil marine faunas as indicators of climatic conditions. (Smithsonian Rept., 1928, pp. 299–307). This does not mean that no attempts have been made to deduce the character of former climates from fossil marine evidence.

It has long been a dogma that organisms secreting much lime can not thrive in cold waters. From this it has been assumed that the presence of corals in the Upper Ordovician of northern Greenland, and eastern Ellesmereland indicates the existence at that time of warm water climates. However, much more must be known than the mere presence of corals before such a conclusion can be drawn. Even at present certain types of coral exist much farther northward and at much lower temperatures than ordinarily suspected. As long ago as 1914, Pratje reported the presence of 4 species of corals along the western coast of Norway, as far as its northern

edge. These corals range along the entire width of the continental shelf bordering on that coast, down to depths as low as 350 to 1000 feet below sea level, and at temperatures as low as 44° F, which is only 12 degrees above the temperature at which ordinary water freezes. These species belong to two genera of Oculinidæ, namely Lophohelia and Amphihelia, and one genus of the Eupsamidæ, namely Dendrophyllia. (Centralblatt fur Min. Geol. Pal., 1914, 410–415). Moreover, even at present, it is the reef-building corals, rather than corals in general, which are confined to warm waters. Now, no one who has ever studied the corals of Ordovician or Silurian strata, or for that matter from any other Paleozoic horizons in the Arctic can state that any of these ever formed reefs. Moreover, none of these Arctic corals from Paleozoic strata are even remotely related to modern reef-building corals. Hence any conclusions drawn from their former presence can have no value beyond that of a wild guess.

Again, the calcareous shells of marine mollusks are said not to attain as great a thickness in cold waters as under warmer conditions, but I do not know how well established this observation is. It also has been asserted that in cold waters mollusks do not grow as vigorously and therefore attain a smaller size. But it is probable that any other unfavorable condition also might result in a smaller size. At all events, no difference either in size or in the thickness of the shell has been noticed in the relatively numerous species of brachiopods, gasteropods, and cephalopods found in the Red River formation, of Upper Ordovician age. This formation has the greatest north and south range of any Ordovician formation known. It extends from northern Greenland and the adjacent part of Ellesmereland southward across Hudson Bay and Manitoba, to Montana, Wyoming, and Colorado, a total distance of more than 2000 miles, in a north and south direction, and yet, shows remarkably little difference in the character of its fauna.

In general, marine faunas are controlled in their distribution chiefly by the routes of travel open to them. Under certain conditions, ocean currents may favor their migration to areas far distant from their points of origin. This does not mean that ocean currents carry these faunas along mechanically. However, these currents may take with them those conditions of warmth, or cold, or salinity which these faunas, and the

food on which they depend, find congenial, and which at the same time favor their powers of reproduction. All are familiar with the ameliorating effects of the warm waters of the Gulf Stream on the climate of western Great Britain and Scandinavia. An opposite effect is achieved along the western coast of South America by a northward flowing current of the Pacific, which permits the seals and penguins of the Antarctic to reach the shores of tropical Peru.

At present, the Arctic is almost a land-locked sea. No conspicuous currents are charted as passing through Bering Strait. Moreover, the ameliorating effects of the north arm of the Gulf Stream on the temperature of Arctic waters does not extend north of Spitzbergen or Franz Joseph Land, nor east of Novaya Zemblya. In general, therefore, the present Arctic does not receive any appreciable quantity of warm water from the more southern seas. Hence, it is distinctly colder than the North Pacific and the North Atlantic. In fact, the Arctic, at present, is abnormally cold, much colder than it was during Eocene, Cretaceous, and Jurassic times. For the following reason. During the Middle Eocene there was free communication between the Arctic and equatorial waters across wide areas of western North America and Siberia which at present are above sea level. During this time the warm waters of more southern areas had free access to the open Arctic sea, and produced a corresponding amelioration of its temperature. Berry, the paleobotanist, was the first to explain the far northward extension of tree floras now known only in cool temperate climates, to areas as far north Greenland and other polar areas, during late Eocene times, by calling attention to this wide-spread submergence of continental areas during the preceding Middle Eocene, with its resulting free oceanic connections, pointing out the fact that these Eocene floras occurred along the coasts of Arctic lands, where they would be under the influence of climates affected by warm ocean currents.

Possibly the northward migration of the Canadian or Beekmantown faunas of Newfoundland and the St. Lawrence basin to northwestern Scotland and to Bear Island, between Norway and Spitzbergen, was assisted by the warm waters of some northward flowing current, similar to the present Gulf Stream, carrying the peculiar genus Piloceras to these outlying

areas. In a similar manner, the American genus Gonioceras makes its appearance in the Black River strata of Bear Island, and the American genera Billingsites and Apsidoceras, during Richmond times, may have migrated from Anticosti and the Gaspe region northeastward to southern Norway, Sweden, and Esthonia, the latter forming the southern margin of the Finland arm of the Baltic.

At present, the dominating currents of the northern oceans have a clockwise course, flowing northward along the western part of their circuit, and southward along their eastern part. In the southern hemisphere this direction is reversed, the major currents here having a counter-clockwise course. Such currents often produce very dissimilar distributions of marine faunas on opposite sides of the same continent. For instance, Ernst Stromer has pointed out that in the case of Africa, both at present and during Pleistocene times, coral reefs extended far south along the east coast but were almost entirely absent on its west coast. Again, during Eocene times, the nummulitic foraminifera extended along the eastern coast of Africa as far south as the southern end of Madagascar, while, along its western coast, they reached only the southern border of Nigeria, which is 2000 miles farther north. This suggests that Africa was an independent continental mass, widely separated from South America and also from eastern lands, at least as early as the Eocene.

We have become familiar in recent years with the theory of continental drift, proposed by Wegener. This theory calls attention to the similarity of the western outline of Europe and Africa, and the eastern outline of North and South America. It also imagines that the two sets of continents, now widely separated, formerly were in contact with each other. Gradually the American continents drifted westward, separating from Europe and Africa, and the intervening Atlantic Ocean originated. This is a bold and inviting theory. A more detailed study of its implications, however, will reveal many difficulties. In the first place, the two sets of continental outlines do not match as well as, at first thought, supposed. In the second place, it ignores altogether the physical improbability of such a shift, no adequate force being known. In the third place, it does not give enough attention to the difference of tectonic structure of the continents east of the Atlantic, compared with

those on its west. And, in the fourth place, it does not account for the great differences in the faunal life of the two sets of continents, when compared with each other.

Indeed, as far back as the Permo-triassic, according to Diener, the vertebrate life of South Africa and that of South America already was too different to admit of any contact at that time between these two continents. And it should be remembered that according to the Wegenerian theory at this time Africa and South America were supposed to have been still in direct contact.

You all are familiar, of course, with an earlier theory which attempted to account for the similarities of life found, at various periods of geological history, in southern Africa and in the southern part of South America. This is the theory of a former land connection which bridged that part of the Atlantic which was between the southern part of these two continents. This theoretical land was called Atlantis. This also was an inviting theory. However, as our knowledge of the distribution of life in past geological ages grew the evidence accumulated that the ancestors of the animals, now in common to the southern parts of Africa and of South America, once were widely spread over more northern lands, where they probably had their common origin. At least, such a long and thorough student of Tertiary vertebrate faunas as W. D. Matthew was strongly opposed to any theory involving any form of land connection between these two continents, insisting that our knowledge of the evolution of these vertebrates led to a directly opposite conclusion, namely the entirely separate development of these two sets of faunas, subsequent to their northern origin.

Almost all marine life found in fossil form on the surface of the earth originated in the shallow seas. Deep sea fossil faunas practically are unknown. The plankton, or that part of the life of the sea which floats at or near its surface, forms only a small part relatively of the total fossil life known. Evidently the life now found in fossil form migrated chiefly along the shallow parts of the sea and most of it could not cross deep waters. In consequence, it is impossible to give any intelligent consideration to the migration of existing or of former faunas without any knowledge of the present or former distribution of the shallow seas, and of the intermediate great ocean deeps. As the result of numerous measurements

of the depth of the sea at numerous widely distributed localities it now is very well known that the Atlantic is divided along its entire length, from Iceland to the Antarctic, by a continuous ridge, about equally distant between the two sets of continents eastward and westward, and separated from both sets by equally long and correspondingly deep depressions of the earth's crust. This long median ridge is known as the Atlantic ridge, and it follows in direction the median path between the sinuous outlines of the two sets of continents mentioned. Wegener and his adherents would interpret the great deeps on the two sides of the Atlantic ridge as caused by tension, in which case the Atlantic ridge would represent a narrow strip left between two major fissures, or lines of tension. Recently, however, Henry S. Washington found, on studying the plutonic rocks of the St. Paul's Rocks that these rocks had a sort of gneissoid structure (not gneissoid in color) which suggests crystallization under the influence of lateral compression, which is the exact opposite of tension. Since these St. Paul's rocks lie on the *crest* of the Atlantic ridge, half way between the mouth of the Amazon and the nearest part of the African coast, they suggest that this ridge is of an anticline structure, and that the two deeps on either side represent synclines of an enormous magnitude.

It is of special interest to note that our present knowledge of the sea bottom indicates no trace of a former land connection between South Africa and South America, corresponding to the imaginary land Atlantis.

This leaves for consideration another much mooted problem, that of the wandering of the two poles of our rotating earth. In order to account for the peculiar geographic distribution of certain faunas during past as well as present times on the surface of the earth, certain geologists have attempted to account for these anomalous distributions by imagining a different location for these geographical poles in former ages, with an accompanying shift of the climatic zones. However, this theory leaves out of account certain striking evidences of the presence of poles in remote ages at practically the same locality where they are now. For instance, the circumpolar distribution of the cool temperate tree flora durting Upper Eocene times, already discussed, favors the location of the north geographic pole close to its present position. There

was a similar circumpolar distribution of tree life during the Jurassic in the northern hemisphere. In the southern hemisphere, during Permian times, there was a similar circumpolar South Africa, Southeast Brazil and Argentina. Even as early as the Huronian, there appears to have been a circumpolar distribution of glacial conditions in such countries as the southern half of Canada, the northern end of Norway, the Spitzbergen group of islands, and the mouth of the Lena River in Siberia. Such observations on the circumpolar distribution of similar climatic conditions suggest that throughout the known geological history of the earth the location of its geographical poles was at least approximately near their present location.

AN OPTIMISTIC VIEW OF THE EVOLUTION OF SCIENCES.

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The American Association for the Advancement of Science has fifteen sections devoted to the activities of specific science or related groups. Science has been defined as accumulated and accepted knowledge which has been systematized and formulated with reference to the discovery of general truths or the operation of general laws. In this sense a specific science is any branch or department of systematized knowledge considered as a distinct field of investigation or object of study. If we accept this definition the fifteen sections are in reality science sections. In fact, standard dictionaries define all the fields of knowledge represented as sciences except history and the Association itself has designated section "L," Historical and Philological Sciences. This broad view of science and the sciences is the one accepted for the present purpose.

While many fields of knowledge are accepted as sciences, only Physics, Chemistry, Biology, Psychology, Sociology and Economics will be taken as illustrations. For our purpose Physics is defined as that branch of science dealing with those phenomena of inanimate matter involving no change in chemical composition. From the viewpoint of the complexity of original subject matter Physics may be considered the simplest of the sciences mentioned. No doubt, due to this simplicity and the availability of its materials Physics was one of the first bodies of knowledge to be accepted as a science.

Chemistry is defined as the science that treats of the composition of substances, and the transformations which they undergo. Since Chemistry involves transformations in the inanimate matter of Physics, it is to that extent a more involved science. It was as a consequence accepted later as a field of knowledge worthy of the efforts of scholars and as a suitable subject for students. In the sense that art relates to something to be done in contrast to science as something to be known, the art period of alchemy made its contribution to modern

chemistry. Likewise the periods of iatrochemistry and of phlogiston made contributions. However, we trace our modern chemistry back more definitely to the work of Lavoisier.

Biology is the science of life; the branch of knowledge which treats of organisms. As such, Biology involves more intricate and elusive subject matter than do Physics and Chemistry. On account of the difficulties involved in establishing controls and in accumulating tested knowledge the workers in the simpler sciences are prone at times to deny the biologist unqualified admission to the science fraternity. The value of Biology and the perseverance and caution of its workers, have however, long since resulted in the establishment of a science of Biology with its various branches.

Psychology is the science of mind; systematic knowledge and investigation of the genesis, powers, and functions of mind. Just as Biology is considered more involved than Physics or Chemistry so in turn Psychology in its pursuit of knowledge of the consciousness of life has had more difficulty in finding its place as a science. The techniques involved in the study of Psychology differ so markedly from those associated with the measuring instruments of Physics, the balance in Chemistry, and the microscope in Biology that we should not be surprised. The fact that the psychologists are so divided by their theories has been a factor in their tardy acceptance. In spite of the reluctance of the older sciences, Psychology has now been generally accepted.

Sociology is defined as the science of the constitution, phenomena, and development of society. Sociology involves the complexities of life and consciousness with all the added difficulties in adjustment attending the interplay of conscious life in groups of various sizes. Many thinkers maintain that Sociology can never be a science but since the time of Comte the claim for this right has made progress. The greatest difficulty individual scientists have is in the recognition of the worth of techniques of scientists in other fields. The statistical method of Sociology with its use of the expression, probability, is almost too much for the older sciences.

The physicist and chemist deal with 25,000,000,000,000,000,000 molecules per cubic centimeter of gas or 33,667,000,000,000,000,000,000 molecules of water per cubic centimeter. They do not face all the hazards the sociologist encounters in individual differences of human beings in a small community. The

physicist and chemist, in particular, should be very tolerant of the efforts of the sociologist to determine the statistical significance of the different phenomena observed in small populations.

Economics is the science that investigates the conditions and laws affecting the production, distribution, and consumption of wealth. This science is included not so much because of a logical place in the order of complexity of the other sciences named but more on account of its timely interest. We may judge from the present condition of the world that there is no true science of economics or that the best economists are not trusted and such scientific knowledge as exists is not practiced. This conclusion is obvious in spite of the slowly accumulated and tested knowledge since the writings of Adam Smith in 1776.

It is difficult to divide the sciences into sub-groups. We may call Physics and Chemistry physical sciences, and the others considered biological and social sciences. For the present purpose the older and more commonly accepted sciences of Physics, Chemistry and Biology will be referred to as exact or material sciences, and, the newer and more reluctantly accepted, Psychology, Sociology and Economics will be referred to as social sciences.

A mixture of extravagant praise and equally bitter condemnation has been heaped upon these and other material sciences. These sciences have been commended as making possible the material advantages of our present civilization. They have been blamed for contributing to an increasing disregard for the accepted social values. This machine age has had to face the anomolous charge of bringing hunger to many because of an over-production of food and of depriving many people of the very benefits of the age because too many of these benefits had been produced. It seems only fair to assume that the material sciences have been working effectively and have the power to do much more. They have indeed made possible our material civilization and, in fact, also they make possible the very best social civilization. By them all the necessities and the luxuries are produced with an average individual expenditure of time that allows leisure for transforming the social studies into real sciences.

Our hope then seems to lie not in decreased interest in the material sciences but in using the leisure afforded by them in

perfecting the social sciences. We now have much more tested knowledge in Psychology, Sociology and Economics than we are using. We may reasonably hope that intensive, continued reasearch in these fields, equivalent to that given in the past to the material sciences, may produce comparable results. Confidence in the work of the social scientists should result in the establishment of a social order respected and observed by an improved race of people. The economist and sociologist may expect to assume the burden of so organizing society that it would be impossible for over-production and want to exist simultaneously on the earth. The social scientists are ready to assume their responsibilities and the next step is to train a generation that will turn as readily to them for guidance in these fields as the present generation depends on the physicist, the chemist and the biologist. Because of the sobering influence of such a responsibility, we need have little fear of extravagance of promise or action. The accepted sciences may do well to drop their double standard of viewing one group of sciences as exact and another as inexact. They should lead in the unqualified acceptance and encouragement of the social sciences.

If our social order is to come under the dominant influence of science it seems worth while to consider what will happen to some of the arts that have concerned themselves with society. The oldest and most highly respected of these arts is Religion. We have in this art to deal with elements of belief, faith and prejudice which seem diametrically opposed to the cardinal principles of caution, control and tests in science. However, in 1873, F. Max Muller had written an "Introduction to the Science of Religion." We may hope that Religion may eventually be saved for a scientific age by the acceptance of the method of science.

What attitude are we to take concerning the conflicts of theories in the social sciences? We must follow the plan we have always used in the older sciences. The conflicts must serve as a stimulus to more intense and exhaustive research. The conflicting doctrines in science have almost invariably resulted in bitterness—also a great amount of experimental study. It is not possible to condemn too heartily the attitude of the chemist who would get the camel through the eye of the needle by dissolving him in nitric acid and then using a squirt gun.

Finally, a word of caution seems appropriate. Should we displace entirely an old established art such as Religion because it involves some unscientific principles and practices? No more should we discard this art than that of pottery-making while we are developing a science of ceramics. The vessel of the pottery craftsman may be crude. It may contain unnecessary ingredients; some very valuable ingredients may have been omitted, but, if it makes a satisfactory container it has served a useful purpose. Furthermore it is worth while to be reminded again that our oldest sciences such as Chemistry and Astronomy were preceded by the arts, alchemy and astrology. When we feel most certain that we have found the final solution we may well recall Oliver Cromwell's exhortation, "My brethren, by the bowels of Christ I beseech you, bethink you that you may be mistaken."

AUTHORS' ABSTRACTS

OF

SCIENTIFIC PAPERS AND DISCUSSIONS AT THE OXFORD MEETING OF THE OHIO ACADEMY OF SCIENCE ON APRIL 2, 3 AND 4, 1931.

All persons delivering addresses or presenting papers at the Oxford meeting were asked to prepare and submit abstracts for publication in the Proceedings of said meeting. The following have been received by the Secretary in time for inclusion in this report. These are arranged by sections and numbered consecutively for convenience of reference.

A. THE SECTION OF ZOOLOGY.

DR. WENCEL J. KOSTIR, Ohio State University, Columbus, Ohio,
Vice-President.

1. *Micromoving Pictures of the Circulation in Living Bird Embryos.*—By BRADLEY M. PATTEN, Western Reserve University, and (by invitation) THEODORE C. KRAMER, Baldwin Bird Research Laboratory, Cleveland.

(Moving-picture projection.)

Moving pictures of chick embryos during the second day of incubation. Scenes showing the handling of material, manipulation of apparatus, etc. Cuts from films showing the spasmodic intitial contractions of the heart, the beginning of the movement of blood corpuscles in the vessels, and various views of the circulatory mechanism after it has settled into regular rythmic activity.

2. *Laboratory Study of Living Birds.*—By S. PRENTISS BALDWIN, Baldwin Bird Research Laboratory, Gates Mills, Ohio.

This bird laboratory is a growth from the bird banding which has been carried on at this station and at Thomasville, Georgia, since 1914. No attempt is made to collect birds as skins, nor to observe them in groups, but instead the work is all with individuals marked by the numbered bands of the Biological Survey.

From handling many birds it appeared that it is possible to handle eggs, and young birds, and to trap adults freely, without causing them to desert the nests from fear.

Devices for mechanical recording of nest temperatures, and continuous record of activities day and night have been adapted to the work, described in the *Auk*, Vol. XLIV, April, 1927, and other mechanical apparatus for recording access to the nest have been invented and are described in the *Auk*, Vol. XLVII, October, 1930. These make automatic record of incubation, feeding the young and other nesting habits.

With Dr. Kendeigh as Research associate, and other assistants, it is possible to operate four hundred nest boxes, scattered over one

hundred estates, handling 250 adult house wrens and twelve hundred young birds in the season, in addition to 2,000 or more other birds from the traps, thus supplying abundant material for the Laboratory.

Studies are made of physiology of birds, body temperature, metabolism, sex differences, as well as incubation, nesting habits, mating, migration and distribution.

Embryology studies are made and in co-operation with Dr. Bradley Patten, of Western Reserve Medical College, a micro-movie has been constructed and Dr. Patten has taken interesting films of the first beginning of heart beat in the developing chick. Apparatus is now being constructed for keeping accurate record of the heart-beat in adult birds under different and controlled conditions.

3. *Regulation of Body Temperature in Birds.*—By S. CHARLES KENDEIGH, Baldwin Bird Research Laboratory and Western Reserve University, Cleveland, Ohio.

Body temperatures of passerine birds are very variable between the limits of 102° and 113° F. This was determined through use of thermocouples and potentiometer pyrometers. The thermocouples were prepared in various ways and used down the throat of the birds and in the nest. Variations in muscular activity cause the most pronounced variations in body temperature. The maintenance of a high body temperature is also dependent upon adequate nutrition. Air temperatures affect the body temperature of the bird in an inverse manner, probably through an influence on metabolism and heat production. Excitement produces a rise in body temperature. The effect of these factors on the bird in nature is shown in the daily rhythm of body temperature, and in daily and seasonal fluctuations. Heat loss from the body seems to be largely controlled through the lungs and air-sacs, since the surface of the body is covered with feathers. The mechanism for regulating heat loss, however, is inadequately developed to compensate for variations in heat production, as caused by the factors above mentioned. This inadequacy may be partly responsible for the higher temperatures of birds over mammals. A consideration of these facts in connection with the development of temperature control in young birds, suggests that homoiothermism could not have developed in the evolution of the class until feathers were evolved and the air-sacs began to expand through the body.

4. *Nesting Success of a Song Sparrow Population in 1930.*—By MARGARET MORSE NICE, Ohio State University, Columbus.

Thirty pairs were studied, 44 of the nesting adults being banded with celluloid and aluminum bands. Fifteen of the adults disappeared during the season, 7 new individuals coming into the area, so that only 25 pairs and two lone males survived in July. Sixty-one nests were found, 32 of which came to premature ends, but 29 raised 102 young. As to the number of successes and failures of 16 pairs that survived the season, one pair had 4 failures and no success, 2 had 1 success and 3 failures, 6 had 1 success and 2 failures, 1 had 2 successes

and 2 failures, 5 had 2 successes and 1 failure, while 1 had 3 successes and no failures. Fifteen pairs that survived the season raised the following numbers of young: 0, 2, 2, 3, 3, 3, 4, 4, 4, 4, 5, 6, 7, 7, 10—a total of 64, an average of 4.3 a pair. The nesting season started later than in 1929 and ended early, many of the adults beginning to molt in mid July, completing the molt about two weeks earlier than the previous year. About 38 per cent of the eggs or young were eaten by enemies, 3.5 per cent carried off by boys, 5 per cent lost through cowbirds, 5 per cent lost through parental inefficiency, and 8.6 per cent deserted (in most cases because of the death of the incubating bird). The worst enemies of the young appear to be rats and cats; of the adults, cats and boys.

5. *The Morphology of the Anterior Sympathetic Nervous System of Lumbricus Terrestris.*—By C. G. ROGERS AND T. T. CHEN, Oberlin College, Oberlin, Ohio.

This investigation was undertaken because of differences of opinion expressed by various authors since the work of Clarke in 1856 concerning the existence of an autonomic nervous system in the earthworm. The method used was for the most part simple dissection of worms preserved in alcohol under a binocular microscope under very heavy illumination. This dissection was concerned only with that portion of the autonomic system which might appear upon the wall of the pharynx. Dissections were made from the dorsal, ventral, and lateral aspects, and the portions of the system thus displayed were sketched by means of a camera lucida. Some histological preparations stained with Delafield's haemotoxylin and eosin and also various silver and gold chloride preparations were made and examined. The general conclusions were as follows:

1. The sympathetic nervous system of the earthworm consists essentially of three parts: (1) The six nerves connecting the commissure and the gangliated chain. (2) The gangliated chain. (3) The two sets of nerve trunks leaving the borders of the chain, one set running anteriorly and the other set posteriorly.

2. The nerve trunks branch freely and usually form enlargements when two meet. These trunks and their branches form a delicate plexus upon the wall of the pharynx.

3. As the plexus runs backward along the esophagus and forward toward the mouth, the nerves become finer and finer and their arrangement becomes more complicated.

4. There is variation diversity in the arrangement of the sympathetic nervous system between individual worms and between the right and left sides of the same worm.

5. The plexus of the right side is continuous around the pharynx with that of the left side.

6. Ganglion cells in the chain of ganglia do not differ from those found in the commissure. Within a ganglion they are located chiefly in the periphery.

6. *Dietary Habits of Barn Owls in Ohio.*—By ARTHUR STUPKA, Ohio State University, Columbus.

The work on this problem was begun in January, 1930, when an accumulation of barn owl pellets, collected from the cavity of a hollow tree on the Ohio State University campus, yielded over 1,100 skulls. Upon examination of this material it was found that the common short-tailed meadow mouse (*Microtus pennsylvanicus*) made up the great bulk of the food of this species of owl. Other mammals included in the pellets were white footed mice, shrews, and rats. Birds comprised but two per cent of the entire quantity of skulls. A few months later a still greater accumulation of pellets of the barn owl was collected from the attic of a long deserted school house near Buckeye Lake, Ohio. Over 5,100 skulls were represented in this material. As in the case of the former accumulation, *Microtus pennsylvanicus* made up the bulk of the owls' food. Birds represented but one per cent of the amount.

Later in the year a third accumulation was collected from three localities at Toledo, Ohio. This amounted to more than 1,800 skulls. Examination of this material showed that the dietary habits of the Toledo barn owls was very similar to that of the barn owls stationed at Columbus and Buckeye Lake. Altogether more than 8,200 skulls have been examined to date. Aside from its value in the determination of the economic status of these birds, this study has revealed factors of interest which pertain to the habits and distribution of the fauna represented in the pellets.

7. *Parasites of Buckeye Lake Fish.*—By RALPH V. BANGHAM, College of Wooster, Wooster, Ohio.

This report is the result of a part of the survey conducted at Buckeye Lake during the summer of 1930 for the Ohio Conservation Department. The ecological conditions were quite different from those in many other lakes. At one location, a pond on Cranberry Isle, peculiar parasite infestation was found. At all of the other locations fish were obtained from the open lake or its tributaries. These were taken at forty seining stations, in the fyke net and in a gill net. Five hundred fish belonging to thirty-eight species were examined. Many were examined while their parasites were yet alive and identifications made as far as possible. All were fixed and several specimens have yet to be stained and mounted for complete identification.

When compared with Ohio stream fish or fish from Lake Erie, the number of species of parasites found in Buckeye Lake was quite low. In few cases was the degree of infestation heavy in any fish. In the case of young gizzard shad with an encysted sporozoan and of several species carrying the gill copepod *Ergasilus versicolor*, there was loss of fish and noticeable lowering of vitality.

Data are given regarding infestation of these fish with protozoa, flukes, cestodes, nematodes, acanthocephala, parasitic copepods and leeches. Comparisons are given for fish not native to the lake which have been planted there, and the infestation of these forms where they are normally found.

8. *A Gilled Oligochaete New to America. Branchiura sowerbyi in Buckeye Lake.*—By WARREN P. SPENCER, College of Wooster, Wooster, Ohio.

While studying the bottom fauna of Buckeye Lake under the survey made by the Ohio State Department of Conservation in September of 1930, the writer found several specimens of a remarkable annelid worm with a pair of gill-like processes on each of the segments in about the posterior third of the body. This worm, *Branchiura sowerbyi* of the Tubificidæ, has formerly been recorded from the "Victoria regia tank" in the Royal Botanical Society's Gardens, Regents Park, London, the Botanical Gardens of Hamburg and Gottingen, several canals and ponds in France, from India and Japan. This is the first record of *Branchiura* from the western hemisphere.

It was taken at six different stations from the bottom of Buckeye Lake, three of these near Round Island, one near the north shore opposite Round Island, one near Beech and Elm Islands, and one near the south shore between Moonie's and Gibson Islands. This indicates that the worm is fairly well distributed in the central part of the lake. If it is an introduced species it must have been established for several years to have gained its present distribution.

9. *Tanais cavolinii Milne-Edwards (Crustacea).*—By S. R. WILLIAMS, Miami University, Oxford, Ohio.

Tanais cavolinii is a small isopod-like form found in salt water near the shore on both sides of the Atlantic.

The group of the Tanaioidea shows relationships to the Amphipods, Cumacea and Mysidacea, as well as to the Isopods. If the Malacostraca be divided into a lower portion, the Pericarida and an upper portion, the Eucarida, then these orders just mentioned show the following characters.

PERICARIDA	EUCARIDA
At least four free thoracic somites	Cephalothorax covered by a carapace
Female with brood pouch	Young carried on abdomen
Elongated tubular heart	Short median heart
Few and simple hepatic caeca	Complex liver (hepatopancreas)
Thread-like sperms	Star-shaped sperms
Direct development	A metamorphosis
A movable lacinia on mandible	No lacinia

The Tanaids show the following characters like the Cumacea or Mysidacea: (1) Fusion of the first two thoracic somites with the head instead of one as in most of the Isopoda and Amphipoda. (2) A pair of branchial lamellae (epipodites) attached to the maxillipeds and

extending into the branchial chambers under the postero-lateral edges of the carapace. (3) Eyes elevated as though stalked (Mysidacea), but not movable.

Characters like Amphipoda: (1) Anterior thoracic heart, as opposed to more posterior heart in Isopoda. (2) Pleopods (abdominal swimmerets) natatory. Respiratory pleopods in Isopoda.

Characters like Isopoda: (1) General dorso-ventral flattening. (2) Young hatched from egg in brood pouch without last pair of legs or the swimmerets, as opposed to complete young in the Amphipoda.

Character like no close relative: First thoracic legs, gnathopods, chelate.

10. *The Respiratory Apparatus of Parajulus impressus Say.*—By R. A. HEFNER, Miami University, Oxford, Ohio.

In general, the respiratory structures of this diplopod consist of the following parts:

(a) Two pairs of spiracles open on each of the segments except some of those in the anterior region. These openings are located antero-laterally to the articulation of the appendages with the body. The spiracles are holopneustic.

(b) Each spiracle leads into a tracheal cavity which expands at the distal end. The hypodermis of the body wall extends into and lines this cavity.

(c) From the distal end of the tracheal cavity lead many (about twenty-five) tracheoles. These extend into the body cavity, many of them continuing through several segments. Scattered nuclei among these tracheoles indicate the cellular origin of the latter.

10a. *Preliminary Report on Phototropic Responses of Drosophila hydeii*—By WALTER S. WILDE.

Demonstration of apparatus used in determining the relative phototropic activity of several mutant eye-colored flies of *D. hydeii*. The apparatus used is similar to that employed by McEwen in testing the responses of *D. melanogaster*. Comparative results of wild type and mutant forms of *D. hydeii* are given. This problem will be continued and amplified throughout the coming year.

11. *Notes on the Ecology of Some Grasshoppers of the Genus Melanoplus in Southeastern Ohio.*—By EDWARD S. THOMAS, Ohio State Museum, Columbus, Ohio.

The genus Melanoplus (Orthoptera, Acrididæ) embraces a large number of closely related species of grasshoppers, 17 of which are known from Ohio. Observations, mainly in the hill country of Hocking County, Ohio, indicate that each species occupies its own ecological niche. While two or more species may be found in a given habitat on occasion, this is usually due to overlapping and under optimum conditions, a

given species occupies its habitat to the exclusion of other forms. A study of the nymphs will probably furnish the best index of optimum conditions.

Although no species is found in true forest, all of the short-winged forms are essentially sylvan in habit, being found in the vicinity of trees or shrubbery. This is also true of the long-winged form, *keeleri luridus*. *Punctulatus* is our only strictly arboreal species.

Femur-rubrum, *differentialis* and *bivittatus* are characteristic of hydric to mesic habitats; *mexicanus atlanis*, *decoratus*, and *scudderi* of xero-mesophytic; and *confusus*, *luridus*, *obovatipennis*, *punctulatus* and *fasciatus* of xeric situations.

A careful study of limiting factors is required before definite conclusions can be reached. Moisture and temperature are probably most important, although food-plants and the texture, composition and relative acidity of soil may be factors.

12. *Some Observations on the Habits of Passalus cornutus (Coleoptera).*—By WARREN C. MILLER, High School, Bedford, Ohio.

The Passalus beetles make up one of the four families of the series Lamellicornia. Passalus cornutus is the only species found in the United States. It is widely distributed, forming colonies, which make rough, irregular galleries in damp, partly rotten wood such as logs, stumps, sawdust piles, etc.

The beetles are highly social in nature, living with their progeny during the entire period of metamorphosis. Various sex combinations have been found taking care of the young as two females, two males, two females and one male, etc. The adults chew up the wood for food, both for themselves and the larvæ. The larvæ can live without adult care but become dwarfed and the period of development is lengthened. The protective instinct for the care of the young is extremely marked. The adults show fight at the least disturbance.

The larvæ are easily recognized by the peculiar adaptation of the hind pair of legs which form a stridulating organ, thus giving them the appearance of having only two pairs of legs. The period of larval devlopment is very rapid, about six weeks elapsing from first to last instar.

Pupal case building is a cooperative affair between larvæ and adults. The adults assist in the formation of the cases, especially the outsides and keep them in repair during the entire pupal period. The pupal stage is short, averaging ten days, and the newly formed imago is brownish red in color, very soft, but extremely active. The wing covers gradually fuse together precluding any possibility of flying. While the flying wings are well formed there is no evidence for any other use than as an accessory in sound making. From four to eight weeks is necessary for the newly formed adults to change in color to a glossy black.

Cannibalism is present among both adults and larvæ and this accounts for the comparatively small number of larvæ which finally reach maturity.

13. *A Limnological Survey of the Hocking River.* (a) The Plankton of the Hocking.—By LEE STEWART ROACH, Ohio University, Athens, Ohio.

The Hocking is a swift river traversing a rapidly eroding clay region. The plankton is rather uniformly distributed throughout the length of the river. During the autumn Copepoda were the dominant zooplanktonts. The winter dominants were Rotifera. Bacillariaceæ were the dominant phytoplanktont, Cyanophyceæ the least abundant and Chlorophyceæ intermediate. Protozoa were fairly numerous decreasing in the main with an increase in zooplankton, especially Copepoda and Rotifera.

Of the factors studied, light, acidity, current, chemical conditions of the water, and temperature, only the latter two showed variation that correspond with changes in plankton.

Temperature range from October to March was 13–1° C. Plankton abundance varied directly with temperature. All phytoplankton varied directly in the same relative proportion. Of the zooplankton Cladocera are apparently the warm water dominants, while Rotifera are the cold water dominants. Copepoda were the dominant medium temperature forms. Zooplankton as a whole however decreases and increases directly with the temperature.

The chemical conditions studied varied so little, at the majority of the stations, that no correlation with plankton could be made. However at three stations, below the city of Lancaster the river was undeniably polluted with domestic sewage (as indicated by increased free and albuminoid ammonia, nitrates and nitrites, and decreased oxygen) and there was a direct correlation with plankton. On the whole, total plankton decreases with pollution increase. However Cyanophyceæ increased directly with pollution, as did the Protozoa. Rotifera increased with a certain degree of pollution but diminished with septic conditions.

14. *A Limnological Survey of the Hocking River.* (b) The Bottom Invertebrates of the Hocking.—By WILLIAM B. LUDWIG, Ohio University, Athens, Ohio.

The Hocking is interesting limnologically because it is chemically affected by domestic sewage, mine, oil-well, and factory wastes.

Forty-seven forms were taken, thirty-five of these being classified to genus and twelve to family only. Chironomidæ and Trichoptera were the most cosmopolitan groups, the latter being uniformly less abundant. The most striking feature concerning the distribution of the other forms was the great abundance of a characteristic type at one or two stations and its scarcity or absence at all others. At two consecutive stations, having domestic pollution, there were 295,000 and 96,000 Tubificidæ respectively per square meter; at another station there were 900 Ancylus; at a third 16,338 Goniobasis; and at still another 1624 of the isopod, Assellus, some amphipods, and 200 leeches.

Oxygen and nitrogen, mainly as albumenoid and free ammonia, were important chemical factors affecting distribution. These factors

indicated pollution due to domestic sewage. The pH extremes occurring at different parts of the river were 6.8–7.7. The other important factor correlated with distribution was the substratum. Chironomidæ and Trichoptera were most abundant where there was algæ or solid substratum. The Tubificids depended upon soft, mucky substratum. Goniobasis was most abundant on solid rock. The crustacea and leeches were recovery forms living most abundant where the polluted conditions had improved considerably. May-fly and dragon-fly nymphs and the snail, Ancylus, were present only where there was no indication of pollution. Chironomidæ and Trichoptera became most abundant in these situations.

15. *The Embryology of the Whitefish, Coregonus clupeaformis (Mitchill).*
By JOHN W. PRICE, Ohio State University, Columbus, Ohio.

This is a preliminary study of the embryology of this important food fish of the Great Lakes, from fertilization to hatching. It is based on a series of 803 egg stages, obtained at the State Fish Hatchery at Put-in-Bay, Ohio, under the direction of the State of Ohio Division of Conservation. The eggs were taken at four hour intervals, day and night, from November 21st, 1926, to April 5th, 1927, a total of 134 days, 16 hours. Temperature readings were taken throughout. In this series, every sixteenth stage was studied both from cleared whole mounts and from serial sections. Stages involving early cleavage, germ ring formation, the primitive streak, the formation and closure of the blastopore and the differentiation of the primary germ layers are described from surface views and from sections. Organogenesis from this point to hatching is shown by reconstructions, which were built up from serial sections projected at 100 diameters on graph paper. They indicate the general development of the brain, sense organs, cranial nerves, notochord, muscle somites, pronephric tubules, the gut, branchial folds, and the heart. While this work is in the nature of a general survey, it should serve as a basis for further study, and yield information useful in attacking various hatchery problems relative to whitefish propagation.

16. *Histology of the Intestinal Tract of Two Minnows, Notemigonus Chrysoleucas (Mitchill)* and *Notropis Atherinoides (Rafinesque):—*
By THOMAS SURRARRER, Baldwin-Wallace College, Berea, Ohio.

It was the purpose of this study to compare both histologically and morphologically the intestine of two minnows *Notemigonus chrysoleucas* and *Notropis atherinoides*. These two forms were chosen because of the decided difference in the lengths of the alimentary canal.

A careful study was made of the length of the gut in relation to the length of the specimen, and the following constants were determined; for *Notemigonus chrysoleucas* 1.25 and for *Notropis atherinoides* .89.

The morphology and histology of the gut and its appendages were carefully studied in both cases; giving special attention to the coils of the gut, the presence or absence of valves, the entrance of the bile and

pancreatic ducts, the nature and position of the pancreatic tissue, and a cellular comparison of the various regions of the gut.

Sections were made through the various regions of the canal as well as through the entire viscera, from which the following conclusions were drawn.

CONCLUSIONS.

1. In the study of the two forms no pronounced cellular difference was observed from the esophagus to anus, and both forms seem to be very similar histologically.
2. The entrance of the bile duct is well toward the anterior end of the stomach.
3. The processes of digestion are undoubtedly the same throughout the gut.
4. The goblet cells are present in the region of the stomach.
5. The stomach region possesses a thin wall.
6. Both forms are without pyloric valves.

(a) The above six facts seem to prove rather conclusively the absence of a stomach.

(b) The rather numerous regular folds throughout the gut of atherinoides, proves its large absorbing surface and may account in part for the shortness of the canal.

(c) Both forms possess a pancreas that is distributed through the mesenteries, and which is neither surrounded nor dispersed in the liver substance.

(d) Pancreatic ducts enter the common bile duct; and minute ducts seem to enter at irregular intervals along the canal.

16a. *Skinning Our Parks.*—By S. PRENTISS BALDWIN, Baldwin Bird Research Laboratory, Gates Mills, Ohio.

During the last year, the attempt to provide work for the unemployed has, in many cities, intensified an old problem of park management.

Too often the official order to provide work to the unemployed takes the form of *cleaning up* the park.

Now this "clean up" means to the average man, to cut down all undergrowth, cut out every dead tree, dig every stump, and burn all the brush and it results in a clean shave as to any possible cover or hiding place for wild life, either birds or mammals. I have recently seen twenty acres of beautiful little valley park, on the edge of a city, so skinned that a rabbit could not hide in it.

Park officials and even landscape architects often do not realize that very few birds nest higher than fifteen feet above ground, and many nest on the ground or within five feet of it.

Few, again, appreciate that in cleaning level spaces in the park for recreation, the rougher parts of the park will prove far more interesting if the wild flowers, as well as the birds and small mammals are allowed to live and associate with the human population.

An argument for skinning is often heard, that for protection of women and children from rowdies, it is necessary to remove every

shrub or shelter. No doubt there is often good reason for the argument, but plant, then, groups and clumps of thorn bushes, wild roses, wild blackberry, barberry and other low cover, and by all means leave the leaves in the autumn to rot and feed the trees and shrubs.

This is an appeal to nature lovers to keep your eyes on the parks and persuade the authorities in charge to allow the smaller wild life to live, and join in mutual interest in the association of human life in the parks.

17. *The Heronries of Northern Ohio.*—By E. L. MOSELY, State Normal College, Bowling Green, Ohio.

In the woods of Horatio Wagner, fifteen miles west of Sandusky Bay, great blue herons have built their nests and reared their young since 1913. Having been protected, they have increased, so that there are now 450 nests, all high up in tall trees. More than a thousand eggs probably hatch in these nests each year. The young are fed with fish regurgitated by the parents. To supply so many hungry mouths may require a ton of fish a day. Carp, sheepshead, goldfish and other species are brought from long distances.

Nearer to Sandusky Bay the birds have started a new heronry not far from the automobile road which leads from the south to the bridge across the bay. This and other nesting places for these great birds may prevent further increase in the number resorting to the Wagner woods.

The herons begin arriving in northern Ohio about the middle of March and soon start repairing the old nests. The Wagner heronry is deserted in August, but many of the herons are seen along the streams and marshes until October or November.

B. THE SECTION OF BOTANY.

DR. J. HOBART HOSKINS, University of Cincinnati, Cincinnati, Ohio, *Vice-President.*

18. *Some Poisonous Plants Indigenous to Indiana.*—By GEORGE W. FINLEY, Brazil, Indiana.

During the recent past, much land, formerly cultivated, has been abandoned, practically, and reforestation is gradually restoring conditions favorable to undergrowth of shade-loving wild plants. A great deal of this is very desirable, but it also includes many species harmful to man and domestic animals. A large part of the present population is quite ignorant of outdoor life in its natural environment, and must learn by painful experience.

People flock to our state parks and other forest areas for recreation, and by idle curiosity meet with grief by careless experimenting with unknown forms of plant growth. A few plants capable of causing illness, varying in severity from temporary to chronic disability, or in exceptional cases, fatal, will be mentioned.

Atropa belladonna: The deadly nightshade. Its attractive berries eaten by children may be fatal. First aid in tannic acid infusion and emesis. Physican should be called promptly.

Aconitum napellus: Wolf's bane, or monk's hood. This is a most potent vegetable poison. The rootlets have been mistaken for horse-radish. Antidote, digitalis, administered hypodermically.

Amanita muscaria and *A. phalloides* contain a poisonous alkaloid not altered by cooking which may cause fatality with great suffering unless counteracted by proper antidotes such as atropine.

Conium maculatum: Swamp hemlock. Falsely called wild parsnip. Dangerous to live stock. Persons have been sickened by tasting this for ginseng.

Eupatorium urticaefolium: White snakeroot. When eaten by grazing animals produces a disease known as "trembles," and was the once mysterious cause of "milk sickness." Formerly caused heavy losses in grazing animals in the middle west.

Datura Stramonium: Flower, mature seed and foliage dangerous to children.

Papaver somniferum: The common poppy yields its narcotic opium from the milky juice of the plant and green seed pods. Ripe seeds furnish an edible oil.

Phytolacca decandra: Pokeroot has caused serious illness in children who mistook it for parsnip.

Gelsemium sempervirens: Yellow Jessamine, and *Sanguinaria canadensis* have an acrid poisonous substance in the rhizome only.

The following cause violent dermatitis: *Rhus Toxicodendron, R. venenata, R. diversiloba* and *Urtica dioica.*

19. *Freshwater Algæ of Southern Florida.*—By L. H. TIFFANY, The Ohio State University, Columbus, Ohio.

Some 300 collections of freshwater algæ were made in Southern Florida from Jan. 15 to Mar. 15, 1931. Most of the collecting occurred in the counties of Lee, Charlotte, Collier, Hendry and Glades, although some samples were secured in the everglades and in freshwater pools of the Keys. Desmids were very plentiful in most collections indicating a rather extensive desmid flora in a region that is geologically quite young. Particular attention has thus far been paid, in analyzing the collections, to the Oedogoniacæ and Zygnemaceæ. Species of these algal families occurred most plentifully in permanent pools and ponds and in the cypress swamps. A few forms of Oedogonium and Mougeotia occurred in drainage canals. The larger lakes contained very few species of either of the above families. Twenty-two different species of Oedogonium were identified from a single cypress swamp south of Arcadia. A considerable number of species of Bulbochaete, Spirogyra, Oedogonium, and Mougeotia, previously reported only from South America, occurred in the Florida collections. A comprehensive account of the survey will appear later.

20. *Pollen Analysis of Bacon's Swamp at Indianapolis Evidence of Two Dry Climates in Post Wisconsin Time.*—By PAUL B. SEARS, University of Oklahoma, Oklahoma, Okla., and ADOLPH E. WALLER, Ohio State University, Columbus, Ohio.

The preservation of pollen under the acid conditions of peat offers a clue to vegetation changes in our limestone regions of the Central States. It has been assumed that the retreat of the glaciers was followed by a migration of vegetation confined during the period of claciation to warmer and drier regions. The evidence from pollens presents a more detailed and slightly different story. There have been two dry climatic periods instead of one as heretofore supposed.

Peat studies in the Bacon Swamp show that dry climates existed at the 17 foot level and again at the 5 foot level. At both of these levels grass pollens are abundant. The climate was similar to that now prevailing in some of the grassland regions of the United States. But at the 17 foot level the cool character of the dry climate is attested by birch pollen and by the pollen of closely related alder and hazel, and by spruce and larch pollen.

The warm character of the succeeding climate is attested by the increase of hickory pollen and the decrease of birch pollen. A narrow deposit of pine pollen at the 5 foot level is a good indicator of drying in this period.

A measure of fluctuations in humidity is offered by beech. The beech maxima appear at the 10 foot and 1 foot levels. This shows a reciprocal relation with the grass pollen numbers which are least for these levels. The absence of beech pollen at the 17 and the five foot levels are also highly significant. A slight increase of beech and a decrease of grassland pollen at the 15 foot level suggests that the change from the 17 foot dry condition to the 10 foot humid condition was not necessarily steady.

21. *The Correlation Between Dry Weather and the Storage of Organic Reserves in Alfalfa Roots.*—By C. J. WILLARD, Ohio Agricultural Experiment Station, Wooster, and Ohio State University, Columbus, Ohio.

It has long been known in practice that west of the Missouri River alfalfa can be cut more frequently and at an earlier stage with less injury to the stand than in Ohio. Observations during the dry season of 1930 gave the key to the reason for this. From April 1 to June 15 the rainfall on the Ohio State University farm was 2.74 inches, compared to a normal of 8.08 inches for that period. The average growth of alfalfa hay from May 1 to June 5-14, based on six samples, was only 870 pounds per acre, or 25 pounds per acre per day. However, in the same period the roots gained 1190 pounds per acre (air dry weight) or an average of 34 pounds per acre per day. This compares with 22 pounds per acre per day as the highest previous gain in roots during approximately this period, and a normal figure very much less than this.

In November, 1930, nineteen plots of alfalfa, sown in 1928, averaged 4155 pounds of air-dry roots per acre. The same plots in 1929 averaged 2663 pounds. Records from all over the State showed similar results, the average of 138 samples from five stations being 3560 pounds of roots per acre. Throughout 1930, plots cut frequently recovered vigorously, whereas they do not in a normal season. In 1930 the 4-cutting plots at Columbus went in the winter with an average of 3040 pounds of roots and the 3-cutting plots 3400 pounds. As an average of the 4 preceding seasons these figures were 1750 and 2630 pounds respectively.

Taking all records of 34 days or over secured in our work since 1925, a total of 61 comparisons, the correlation between average daily root storage and average daily rainfall was —.44‡.07.

All these facts go to show that in a dry season a larger proportion of the materials produced by photosynthesis will be stored in the roots and a smaller proportion used for top growth than in a wet season. Consequently, in a dry climate, alfalfa can be cut with far less attention to maintaining root reserves than is possible in the normal climate of Ohio. Also, alfalfa sown in Ohio before 1930 went into the winter of 1930-31 in better condition to resist winter-killing and make large yields the next season than in any season for the past 8 years.

22. *Absorption of Water by Root Systems of Plants.*—By PAUL J. KRAMER, Ohio State University, Columbus, Ohio.

The purpose of this work was to throw additional light on the role of the living cells of the root in the absorption of water and in the development of root pressure. The complex of factors bringing about the absorption of water in transpiring plants seems to be quite different from that operating in plants in which little or no transpiration is occurring.

Experiments in which the pull of the transpiration stream was replaced by the tension developed by a suction pump attached to the cut stem of the plant indicated that reducing the pressure within the conducting vessels materially increased the absorption of water. It appears that the movement of water from the soil into the conducting vessels of the roots of transpiring plants results from the difference in pressure inside and outside the plant. This difference in pressure is the direct result of the tension set up in the hydrostatic system by transpiration. Such a process reduces the role of the living cells of the root to that of mere absorbing surfaces, a role which, in some respects, might as well be filled by dead as by living cells. Experiments indicate that in moist soils as much or more water may be absorbed through a dead as through a living root system.

Positive pressures apparently are manifested only when living cells are present in the root. Experimental evidence supports the view that in plants in which little or no transpiration is occurring water moves from the soil to the dilute solution in the conducting vessels of the root by osmosis across a differently permeable membrane formed by the living cells of the root.

23. *The Loss in Dry Matter in Sweet Clover Roots from Fall to Spring.*—By C. J. WILLARD, Department of Agronomy, Ohio Agricultural Experiment Station; Department of Farm Crops, Ohio State University, Columbus, Ohio.

In the course of studies on the life history of sweet clover, it was discovered that there is a very considerable loss in the weight of dry matter in sweet clover roots from fall to spring, and some special studies were made to determine its amount. As an average of 87 comparisons extending over four seasons, we found 2065 pounds of air-dry sweet clover roots per acre in November and 1728 pounds in the early spring, an average loss of 347 pounds or 16.8 percent. This loss almost certainly measured the amount of material used in respiration during the winter. It was not due to variations in stand or losses of whole plants, for the November samples averaged 169 plants per square yard and the spring samples 173 plants.

That this loss is from respiration is borne out by the percentage of nitrogen in the roots in the fall and spring. This nitrogen would not be used up in respiration, and as a result of using up carbohydrate materials, the roots should contain a higher percentage of nitrogen. As an average of six years, involving 38 comparisons, sweet clover roots contained 3.47 per cent of nitrogen in November and 4.34 per cent in March or early April following. The nitrogen per acre in the roots, as calculated from the average figures above, is 72 pounds per acre in the fall and 75 pounds per acre in the spring.

The hydration of sweet clover roots changes markedly from fall to spring. Over four seasons, the air-dry weight has averaged 33.4 per cent of the green weight in the fall and only 19.0 per cent of the green weight in the spring. Applying these percentages to the average dry weights above, the average green weight of roots in the fall was 6180 pounds per acre, and in the spring 9090 pounds per acre. Thus the green weight increased while the dry matter decreased.

C. THE SECTION OF GEOLOGY.

DR. FRANK J. WRIGHT, Denison University, Granville, Ohio,
Vice-President.

24. *The Gratz Division of the Cynthiana Series of Central Kentucky.*—By J. J. WOLFORD, Miami University, Oxford, Ohio.

The Gratz division of the Cynthiana series is typically represented near the village of Gratz, Owen County, Kentucky. It was first recognized about 30 years ago by Dr. E. O. Ulrich, and subsequently classified as a sub-division of the Cynthiana series by Dr. R. S. Bassler in U. S. National Museum Bulletin 92. Although the Gratz division has been referred to several times by geologists, it has never been studied in detail or even accurately defined.

The Gratz division consists typically of 49 feet 6 inches of fairly even-bedded, blue shale with numerous thin layers of argillaceous

limestone. It exists, in its type locality, between the predominantly limestone Bromley division below, and the Eden shale above. The relationship with the Bromley division is one of conformity. Indications at the top of the Gratz division, however, point to at least a shoaling of the sea at this stage, and probably a disconformity between the Gratz and the succeeding Eden sub-series.

The fauna of the Gratz division is very similar to that of the underlying Bromley strata, but it is notably different from that of the Eden sub-series, although the latter strata are lithologically similar to those of the Gratz division.

In conclusion, the preponderance of evidence indicates that the Gratz division is closely related to the underlying Bromley division. In contrast, the relationship with the Eden division is one of unconformity.

25. *The Devonian Corals of Ohio.*—By GRACE A. STEWART, Ohio State University, Columbus, Ohio.

The corals in the Devonian rocks of Ohio are found distributed throughout the various subdivisions of this system of rocks. By far the greater number occur in the Columbus limestone, and they are particularly abundant in the so-called "coral layer" of the formation. One hundred and twelve species have been listed from the entire system. This number is somewhat over-estimated, however, because in a number of cases the species reported are merely synonyms of others. Eleven new species have been based on Ohio material. The corals are preserved both in a calcified and a silicified condition, the latter being found principally along joint planes and on weathered surfaces. The calcified corals are much more valuable for determination than the silicified ones because the structure is much better preserved.

The Devonian corals of the state have never been studied comprehensively as a group before. Hence the purpose of the present study is to bring together the scattered information already known regarding the corals, and to describe and illustrate the entire coral fauna. During the progress of the work six new species have been recognized.

26. *The Horizon of the Brassfield Limestone in Southeastern Ohio.*—By JAMES W. CUMMINS, The Pure Oil Company, Columbus, Ohio.

The Brassfield Limestone is shown by a series of cross-sections to underly the Clinton limestone of New York at a depth of from twenty to forty feet. These sections drawn through wells drilled in Jackson, Vinton, Lawrence, and Gallia counties show the Clinton to thin towards the west and the Brassfield to thin towards the east.

If this correlation is correct the upper part of the Alger shale is the equivalent of the Rochester shale of New York, and the lower part of the Alger shale is the equivalent of the Clinton limestone of New York. The Brassfield is then the equivalent of the upper part of the Medina formation of New York state. Other well records are cited which support this correlation.

27. *The Origin of Limestone Caverns.*—By A. C. SWINNERTON, Antioch College, Yellow Springs, Ohio.

The two-cycle hypothesis proposed recently by Davis to explain the origin of large caverns in limestone is compared with the hypothesis which was proposed by the writer in 1929, that cavern systems are excavated in the zone of lateral discharge in the fluctuating upper portion of the water table. The Davis view is based on King's concept of ground water circulation, while the writer's view is patterned after J. W. Finch.

A physiographic test which depends upon the direction of flow of the deep-seated circulation is proposed. The application of the test to the orientation of Mammoth Cave and Great Onyx Cave to the Green River implies that the deep-seated circulation is not effective in the formation of integrated cavern systems.

28. *Recent Formation of Dolomite in an Ohio Cave.*—By RICHARD C. LORD, Kenyon College, Gambier, Ohio.

The synthesis of dolomite in the laboratory under the conditions similar to its formation in nature has only recently been accomplished by procedures that can be duplicated by others. Based on personal experience with Ohio brines, and work of Mitchell, of University College, London, and Johnson, of Carnegie Institute, Washington, the writer suggests the possibility of precipitating magnesium when the partial pressure of carbon dioxide in the solution is very low, with consequent lowering of the hydrogen ion concentration. Ammonia and Hydrogen sulfid, which may be present when dolomite is formed, both tend to lower hydrogen ion concentration. Iron is also readily precipitated under conditions of low hydrogen ion concentration and traces of iron are usually found associated with dolomite. Analyses of occurrence of a high calcium stalactite and a high magnesium red sediment from the Ohio Caverns are given in substantiation of this theory.

29. *Some Temperature Abnormalities in Indiana and Kentucky Highs.*—By ROBERT KENDALL AND ERNEST RICE SMITH, De Paw University.

Attention was called to this problem by a recognized minimum temperature at Greencastle, Indiana, December 20, 1929, which was twelve degrees lower than any other record in the State of Indiana. Temperature conditions in high-pressure areas are usually considered to be comparatively uniform. Variations are generally considered to be due to: topographic relief, cloudiness, wind, city effect, and snow covering. Maps illustrating variations over a period of more than thirty years in Kentucky and Indiana indicate the probability that there are other causes of variation and that more accurate and complete data from cooperative weather observers are needed. Not only maxima and minima, but also the time of such records and the relation to barometric pressure would aid in the solution of this problem. It is

suggested that in each state, the United States Weather Bureau supply competent cooperative observers with thermographs, barographs and mercurial barometers to give more complete data.

30. *The Finns in Ohio.*—By EUGENE VAN CLEEF, Ohio State University, Columbus, Ohio.

The mere presence of the Finns in Ohio is not in itself a matter of particular significance. However, when considered in the light of the distribution of Finns in other parts of the United States, these settlements warrant detailed investigation.

From studies among the Finns in the Lake Superior District and in New England, subsequently compared with investigations made in Finland, the writer arrived at certain definite conclusions with respect to the response of Finnish life to its physical environment. The Ohio Finns reveal what seems at first to be exceptions to the rule. If, on the other hand, the activities of the Ohio Finns represent merely an advanced stage in the settlement of a foreign group in the United States, then we may interpret them as normal.

The problem at hand is one which if solved, should contribute much toward a better understanding of settlement. Through such investigations, some light may be shed upon a possible scientific adjustment of migrating peoples to specific environments.

31. *Erosion Surfaces in Eastern Ohio.*—By KARL VER STEEG, College of Wooster, Wooster, Ohio.

Projected profiles and field study of an area of approximately 4,000 square miles in the rugged, unglaciated portion of eastern Ohio, indicate the presence of two well-defined erosion surfaces, the Harrisburg on the uplands and stream divides, at an average elevation of 1,200 to 1,300 feet a.t. and the Worthington (Lexington) at an altitude varying from 900 to 1,100 feet a.t. The Harrisburg in Ohio is correlated with the Allegheny Plateau upland in Pennsylvania. The Worthington in eastern Ohio is correlated with the Kentucky Lowland (900 to 1,000 feet a.t.), located west of the conglomerate escarpment. This area, of which the Lexington Plain is a part, slopes westward and is co-extensive with the lowlands in western Ohio, much of which lies at about 900 feet a.t.

The writer recognizes the existence of three distinct erosion surfaces in the northern Appalachians and Allegheny Plateau region; the Schooley (Kittatinny) on the ridge crests of the folded Appalachians, the Harrisburg on the weaker rock formations in the valleys of eastern Pennsylvania and co-extensive with the upland erosion surface beveling the Allegheny Plateau region and a third, the Worthington (Lexington) erosion level, well developed in Ohio and Kentucky, and which by virtue of its position below the Harrisburg is correlated with the Somerville of eastern Pennsylvania and New Jersey. This seems to the writer to be the most logical interpretation, in the light of present knowledge concerning Appalachian erosion surfaces.

32. *Paragenetic Relations of Galena-Sphalerite.*—By RALPH TUCK, University of Cincinnati, Cincinnati, Ohio.

Examination of galena-sphalerite intergrowths offer an attractive field of investigation of the influence of varying physical-chemical conditions on the order of crystallization and the boundary relations between sulfide minerals, as galena and sphalerite occur in deposits ranging from high to low temperature and pressure.

The usual order of crystallization in the intermediate to deep vein deposits is either that galena and sphalerite are contemporaneous or else the sphalerite precedes the galena, but rarely is there evidence of the galena preceding the sphalerite. As a rule solution boundaries as evidence of paragenesis must be used only with extreme caution and it is more common to find the replacing mineral which is usually galena showing concave outlines towards the sphalerite, instead of convex boundaries as has been suggested by some authors.

Many of the intergrowths from our intermediate to deep vein deposits show such a uniformity in the mixture of the two minerals and such overlapping in period of crystallization that it strongly suggests that the crystallization was initiated from a number of centers.

It is believed that the boundaries exhibited by sphalerite and galena can be in part attributed to rate of cooling. If the cooling is relatively rapid, there will be little if any separation of the galena and therefore the polished section will indicate a contemporaneous crystallization. When the cooling is slow fractionation will be more complete and there will be more evidence of replacement and later deposition of the galena.

It is in the lead-zinc deposits that we find the best examples of zonal arrangement and it seems probable that there is a relation between it and the mutual boundaries exhibited by the sulfides.

33. *Announcement of Plans for the Field Trip.*—By FRANK J. WRIGHT, Denison University, Granville, Ohio.

The annual spring field trip of the geology section of the Ohio Academy of Science will be held May 29–31, 1931. In view of the fact that Memorial Day falls this year on Saturday, most of the work will be planned for Saturday, and Sunday forenoon. The Hocking County conglomerate area will be studied under the guidance of Professor J. E. Hyde of Western Reserve University, who will have entire charge of the excursion. The party will assemble at Lancaster.

34. *A Remarkable Fossiliferous Lens in the Bainbridge Limestone.*—By PAUL H. DUNN, Miami University, Oxford, Ohio.

The Bainbridge Limestone of Southeastern Missouri is described by J. R. Ball in an unpublished report of the Missouri Geological Survey. An outcrop in Ste. Genevieve County, along the Ozora-St. Marys road south of the Greither Hills, and near the University of Chicago Field Station, gives the maximum thickness of the formation as well as the area of the most abundant fauna.

In this outcrop there is exposed one hundred and twenty feet of the characteristic Bainbridge, brick-red, argilaceous limestone and calcareous shale. A lens of greyish-white, in many places coarsely crystalline, massive limestone, five feet thick and six hundred feet long, however, occurs about fifty feet below the top of the formation. This lens carries an abundant fauna characterized by *Merista tennesseensis*. The fossils are in most cases external casts of waxy-white calcite.

Another fossiliferous zone, characterized by a *Pisocrinus* fauna, is found fifteen feet beneath the base of the crystalline limestone.

In other localities the Bainbridge is sparingly fossiliferous or devoid of organic remains.

35. *The Foraminifera of the Bainbridge..*†—By PAUL H. DUNN, Miami University, Oxford, Ohio.

A by-product of the foregoing work which undoubtedly is of greater importance than the actual study itself was the discovery of a number of species of foraminifera in the residue of each sample. W. L. Moreman, who has recently* announced the only other known occurrence of foraminifera in the Silurian of this country, has described and figured several species of arenaceous foraminifera from the Arbuckle (Ordovician), Viola and Chimney Hill (Silurian) limestones of the Arbuckle Mountain region.

As the forms found in the Bainbridge are similar to those discovered by Moreman, there is opened up the strong possibility of accurate foraminiferal correlation of the Bainbridge with the Silurian formations of the southwest.

The detailed results of this study will be published later.

36. *Pre-Mesozoic Stratigraphy of the Central Wasatch Mountains.*—By A. A. L. MATHEWS, Oberlin College, Oberlin, Ohio.

The Pre-Mesozoic stratigraphic section of the Central Wasatch Mountains comprises sedimentary strata ranging from Archean to Permian. It is over four miles thick and consists of sedimentary, metamorphic and igneous rocks.

Several well defined and characteristic unconformities are involved in the groups, showing post-Archeozoic and pre-Mesozoic structures. Many low angle unconformities occur and several erosional breaks are apparent.

The limestones and shales were deposited horizontally under marine conditions; some of the conglomerates and sandstones were laid down along old shores, and the entire mass since deposition and induration has been subjected to orogenic movements, which were followed by erosion, thus exposing the truncated edges of the strata.

The Archeozoic era is represented by an excellent exposure of the characteristic basal complex; the Proterozoic by the characteristic

†These studies were carried on at the Walker Museum, University of Chicago, under the direction of Carey Croneis.

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pre-Cambrian quartzites and slates, and the Paleozoic by the Brigham quartzite, Ophir shale, undifferentiated Cambrian and Ordovician limestones, Swans Peak quartzite, Jefferson limestone, Three Forks limestone, Madison limestone, Morgan formation, Brazer limestone, Weber formation, Park City formation and the Phosphoria formation.

37. *The Earliest Known Cephalopods of America, Europe and Asia.*— By AUG. F. FOERSTE, Dayton, Ohio.

The oldest known cephalopod in Asia is a very small curved species described by Walcott from the Tsinan area, southwest of Peiping, in eastern China, from the Upper Cambrian, under the name *Cyrtoceras cambrica*. Farther north, in southern Manchuria, another curved form, related to *Piloceras*, occurs in strata of Canadian age.

In Europe, the oldest known species definitely known to be a cephalopod is that described by Broegger from the Ceratopyge limestone of Norway, directly over the Cambrian, under the name *Orthoceras attavus*. This species has a straight annulated conch with transversely striated surface; its siphuncle is very small and located close to the ventral wall of the conch. Its nearest relative is a species occurring in the Canadian of Arkansas, and the Norwegian horizon is regarded as also of Canadian age. The peculiar species used as the genotype of *Volborthella*, found in the Upper Cambrian of Finland and of Esthonia, appears to have a small central siphuncle, and in this respect differs from all the earlier cephalopods known from any area in the world. Notwithstanding its strikingly orthoceroid appearance, its affinities with typical cephalopods are not fully established.

In America, the oldest known cephalopod is a straight, laterally compressed, and transversely ribbed conch, apparently related to the genus *Walcottoceras*. It occurs in the Lower Ozarkian of Oklahoma. The Middle Ozarkian of Arkansas and Missouri contains chiefly curved conchs with relatively large siphuncles along their concave outlines. In the Upper Ozarkian straight endoceroids are not uncommon, but are represented by fewer genera than the straight forms.

In general, Cambrian and Ozarkian cephalopods are characterized by siphuncles which either are in contact with the ventral wall of the conch or at least are located near the latter. In the curved species, the siphuncle always is on the concavely curved side of the conch. The great preponderance of curved genera suggests that the earliest cephalopods may have been curved forms. Almost all of these earlier forms apparently belong to the Holochoanoidea.

The single exception known so far appears to be *Volborthella*, which has a central passage through the septa, possibly representing a siphuncle. In that case it would belong to the Ellipochoanoidea, which elsewhere are not known until the Upper Canadian.

It can not be determined at present whether the Holochoanoidea or the Ellipochoanoidea are to be regarded as the more primitive cephalopods. If the Norwegian species *Orthoceras attavus* could be ignored, the evidence would be in favor of the Holochoanoidea. As far as the straight and the curved forms among the Holochoanoidea are concerned, it is equally uncertain which of these are to be regarded as the

more primitive, but, judging from the much wider range of generic variation among the curved forms, the latter are regarded provisionally as the more primitive, especially since the amount of their curvature usually decreases with increasing maturity.

38. *The Status of Paleobotany in Ohio.*—By WILLARD BERRY, Ohio State University, Columbus, Ohio.

During the last four decades there has been little or no work done and published on the fossil plants of Ohio. Since the death of the earlier workers and the publication of the several volumes on paleontology by the Ohio Geological Survey there has been little interest shown in the subject in this State. The mining out of the Youngstown and other important coal areas and the burning of the coal around Shawnee possibly has had something to do with it. There have been a few sporadic attempts at a revival of interest but nothing of importance has come of it. Recently however several fresh starts have been made.

Dr. J. H. Hoskins of the University is studying the fossil trunks of Psaronius and I have begun the study of floral remains from the Carboniferous for the Geological Survey of Ohio.

From various sources it would seem that there existed at one time several large collections of fossil plants from Ohio. Herzer's collections are in part in Washington, D. C.; J. S. Newberry's collections are in New York; of the others only rumors seem to be extant. Lesquereux mentions a "Cabinet" of Dr. Orton's; there was a collection by Andrews of about 30,000 specimens; these are now at Marietta College. There were undoubtedly other collections but what has become of them is a question.

Ohio is especially well suited for the study of Carboniferous plant fossils due to the numerous coal and clay beds overlayed by shale and clay. In this respect we are much more fortunate than our neighbors either Pennsylvania, West Virginia or Illinois.

A complete revision of the Carboniferous plants of Ohio is in progress and any information regarding existing collections will be much appreciated.

39. *Fossil Footprints From the Pennsylvanian.*—By ROBERT H. MITCHELL, Muskingum College, New Concord, Ohio.

At Senecaville, Ohio, in the Cleveland Mine of the Cambridge Colleries there is a remarkable number of fossil footprints. These prints are in the shale above the Upper Freeport or number 7 coal. At a number of places in the roof of the mine the prints are abundant and are fillings of the impressions of the animal's foot.

Perhaps the best preserved prints from this mine are now in the collection of Muskingum College. There are two slabs of the shale, one about one foot and two inches by three feet and nine inches, and contains thirteen prints or parts of prints. These prints are impressions. The other slab is five feet and five inches by one foot and eight inches and contains sixteen prints or parts of prints. The tracks on this

slab are fillings of the impressions and stand out in relief. They are less well preserved than those of the imprints and are more typical of those found on the roof of the mine.

The size of the prints and the shape of those best preserved resemble very closely Ancylopus ortoni Carman.

40. *Is Orogenic Deformation Continuous or Discontinuous for the Earth as a Whole?*—By WALTER H. BUCHER, University of Cincinnati, Cincinnati, Ohio.

Recently, von der Gracht wrote: "It becomes ever more apparent all over the world that it is a general rule that in all geosynclinal basins, folding . . . . increases with depth . . . . . This is caused by progressive folding during sedimentation . . . . ." He implies that such orogenetic folding may have continued through as much as a whole period. As concrete illustration he quotes the work of a German mining engineer, H. Boettcher, in the coal-bearing Pennsylvanian of Westphalia. For these beds, about 10,000 feet thick, "he proves that progressive folding throughout the section caused accumulation of 63 per cent more sediment in synclinal folds than the normal thickness would call for . . . . . This is exclusive of posterior increase and reduction of shales through the mechanism of folding or otherwise after sedimentation." (Bull. A. A. Petrol. Geol., vol. 10, 1926, p. 427).

In a paper entitled "To Question the Theory of Periodic Diastrophism," Shepard reasoned on the assumption that "the time of diastrophism was . . . . not . . . . a point of time, but . . . . extended over a considerable fraction of a period, let us say on the average about a third of a period." He thinks "no harm was done in making such an assumption, because it is becoming well recognized that orogeny is not as brief a process as it was formerly considered." (Jour. Geol., vol. 31, 1923, p. 602).

If orogenic deformation is an act which extends through large fractions of periods, then it may well have been a continuous process as far as the earth as a whole is concerned, since for all periods (except perhaps the Cambrian) one or several orogenic movements have been recorded from some part of the earth or other.

The question involved is of sufficient interest to warrant careful study. In his address, the writer explained the observations on which Boettcher based his conclusions. He showed that the conclusions are valid only if anticlines and synclines have equivalent geometrical form. In the case studied by Boettcher, this is strikingly not the case and his far-reaching inference is, therefore, not valid.

In all carefully studied regions, such as the Paleozoic portion of the Appalachians, there is good evidence that orogenic deformation began after the now accessible sediments had been laid down. Furthermore, wherever it is stratigraphically possible, the length of time involved in the orogenic deformation can be shown to have been short in comparison to the length of the average period.

But even if locally orogenic epochs occupy but a small fraction of a period, orogenic deformation might have been under way somewhere

on the earth at every instant of geologic time. That this is not the case is becoming more and more clear as the number of accurate time records of orogenic movements from all parts of the earth increases. The progress of accurate timing was illustrated by a discussion of the tables of orogenic epochs prepared by R. T. Chamberlin, Blackwelder, and Stille, and by a number of detailed examples.

41. *A Comparison of the Maine and Connecticut Shorelines.*—By HENRY S. SHARP, Denison University, Granville, Ohio.

Due to submergence the shorelines of Maine and Connecticut are very irregular, but the difference in their irregularity is so great that in comparison with the coast of Maine the Connecticut shoreline might almost be described as rectilinear. If the shorelines of both states were straight, Maine's would be slightly more than twice as long as Connecticut's. The shoreline of Maine measures 1,319 miles, that of Connecticut 144 miles in length, so that actually the Maine shoreline proves to be over nine times longer, or roughly four and one half times more irregular than the Connecticut shoreline.

A number of causes may be advanced to account for this marked contrast. Of these the following, dependent upon the presence of a different peneplane at the shore in Connecticut than in Maine, are believed to be most important. The more steeply a peneplane slopes into the sea, the more regular shore will it form; in Connecticut the submerged peneplane slopes southward 50 feet per mile, in Maine 15 feet. The more dissected the surface, the more irregular shoreline will it form when submerged; in Connecticut the Fall Zone peneplane is much less dissected than the New England Upland peneplane in Maine.

42. *Industrial Adjustments in the Miami Valley.*—By A. J. WRIGHT, Ohio State University, Columbus, Ohio.

The Miami Valley in southwestern Ohio challenges the interest of economic geographers; first, because of the importance of manufacturing as a livelihood in this famous farming region; second, because of their continuing sectional importance in Ohio's indrustial production; and third, their economic function is such that they constitute a region with definite industrial individuality. It is with this last characteristic that this paper is concerned.

This industrial individuality is characterized by certain qualities which are not common to other sections of Ohio or to the State as a whole. These qualities may be expressed as: The value of the annual product per worker is low; the value added by the manufacturing process is high; the cost of raw materials with respect to product value is low; the primary horsepower per worker is low.

The dominant industry is the manufacture of industrial machinery, in several phases of which these Valley counties lead the State. It is axiomatic that the manufacture of machinery tends to take place near its market. Among the effects of these industries upon the Miami Valley has been to give this machine-making and machine-using area an

individuality best characterized by "precision." The influence of no other industry is so potent in giving this region an individuality recognized by a trade.

If, as has been asserted, the industrial ideal is regional equilibrium among the workers in the extractive, manufacturing and commercial fields, the Miami Valley approaches this more nearly than any other section of the state.

43. *Summer Rainfall of 1930: A Relative Representation.*—By R. B. FROST, Oberlin College, Oberlin, Ohio.

There are two principal features of the rainfall of 1930 which characterize it as the most unusual in the history of the weather service. The below normal rainfall which occurred, generally, in the eastern and central portions of the United States, and the above normal rainfall generally peripheral to the dry regions.

Although much has been written and said about the so-called "Drought of 1930," authorities are not agreed as to just what constitutes a drought. However all are in general agreement that any criteria for determining a drought should include: (1) the deficiency of rainfall, with its many ramifications, and (2) its effects upon living things.

Monthly rainfall maps for the four months of summer show that there was a gradual advance and intensity of the below normal rainfall condition at the same time there were record-breaking and near record-breaking downpours occurring elsewhere in the United States. The northern path of the summer cyclones and the intensive development and extension of the Azores high pressure over the southern states had much to do with the increasing intensity of the droughty conditions.

44. *Geology of the Vicinity of Ticonderoga, New York.*—By A. C. SWINNERTON, Antioch College, Yellow Springs, Ohio.

The geologic section near Ticonderoga extends from the Grenville series to the Upper Trenton shale with Potsdam overlying the Precambrian-Paleozoic unconformity. Faulted structures are common in the region and can be grouped in three zones. The easternmost belongs in the Green Mountain system of over-thrusts. The westernmost is the boundary fault of the Adirondack massif. The central zone is complexly imbricated and lies in the general position of Lake Champlain. The structural arrangement outlined by the western and the central fault zones is that of blocks which are uplifted toward the south and south-east and dip gently toward the north and north-west. A brief examination of the literature indicates that this structural type is to be found some distance to the north and also to the south and south-west. The conclusion is suggested that block-faulting of this character may be a significant tectonic feature of the Adirondacks.

45. *The Hypsometric Map versus the Projected Profile Method in Depicting and Determining Erosion Surfaces.*—By KARL VER STEEG, College of Wooster, Wooster, Ohio.

In the past, two methods have been used to detemine erosion levels, the hypsometric and profile methods. In the hypsometric plan the erosion surfaces are determined by coloring in, on a topographic map, all the points at a definite elevation or approximately that. The disadvantages of using the hypsometric method are many. A peneplane or erosion surface is not a level one, but rolling, rising toward the divides and descending toward the streams and their outlets. To attempt to color in such a surface seems impossible. The danger lies in getting too many peneplanes. Furthermore, it is very difficult, if not impossible, to picture in one's mind's eye the topography as colored in on a series of contour maps. When such a map is completed it is too large to be published and when reduced to a size suitable for publication, much of the detail must be eliminated.

The major disadvantage of the projected profile is that some of the lower points are concealed by the higher areas. But this can be eliminated to a large degree by using a smaller interval. Projected profiles can be photographed, giving perspective, the effect of depth as well as height and breadth. On the whole, the regular projected profile method, in the opinion of the writer, is superior to any yet devised to depict erosion surfaces.

D. THE SECTION OF MEDICAL SCIENCES.

DR. CHARLES G. ROGERS, Oberlin College, Oberlin, Ohio,
Vice-President.

46. *Some Variations in Muscular Efficiency.*—By W. C. MCNELLY, Miami University, Oxford, Ohio.

In order to determine some factors which influence muscular efficiency, it seemed desirable to determine the amount of variation which could be expected to occur within the individual from time to time.

In the study, a series of tests was used in each of three male subjects during June and July, 1930, using a bicycle ergometer of Prony brake type; two Collins chain compensated gasometers for collecting air; one 600 liter capacity, and one 100 liter capacity; three Haldane gas analysis apparatus, Boothby modification, for analysis of air.

The subjects came to the laboratory in a basal condition and rested for one half hour before mounting the bicycle. After a short rest period on the bicycle, the exhaled air was collected for 10 minutes, measured and sampled. The subject then rode the bicycle for a like period during which the exhaled air was collected, measured and sampled. Over two recovery periods of 6 and 10 minutes respectively the exhaled air was collected and measured and sampled. Later the

samples were analyzed and the metabolism over and above that required in sitting on the ergometer was calculated. The work done was determined for each test. The efficiency was then computed.

Subject	Tests	Mean Work	Mean Efficiency	Standard Deviation of Efficiency
S. H.....	11	10.44 Cal.	22.11%	1.504
MN.....	5	9.84	21.80	1.050
McN.....	5	9.74	22.4	1.47

47. *Oxygen Pulse Under Hypnosis.* By B. M. DAVIS, Miami University Oxford, Ohio.

Report of experiments preliminary to a study on influence of actual as compared with suggested stimuli in an hypnotic subject. Subject was trained to use Benedict-Roth metabolism apparatus under hypnosis. Variations from normal rate of metabolism were determined: First, while subject was resting normally; second, after an interval of about ten minutes in hypnotic state. Several trials were taken to find variations in metabolic rate which should be considered in subsequent experiments.

48. *Health Habits of University Women.*—By MRS. NORMA SELBERT, College of Medicine, Ohio State University, Columbus, Ohio.

In 1928 the writer reported problems and facts which were revealed through a study made with a graduate student, Miss Gladys Grim, and 284 women students in the Ohio State University. Questionnaires, personal conferences, and visits to homes were made. The following questions and answers indicate some of the health problems which concerned investigators and students in 1928.

Question	*Affirmative*	*Negative*
Do you sleep 8 or more hours out of 24?.....	75	209
Do you take tea oftener than once a day?.....	274	10
Do you take coffee oftener than once a day?.....	194	90
Do you play out of doors daily?.....	90	194
Do you drink a pint of milk each day?.....	20	264
Do you eat a fruit or green vegetable each meal?.....	80	204
Do you drink four or more glasses of water each day?.....	75	209
Do you have a bowel movement every morning?.....	124	160

The habit of going beyond the fatigue point is the worst vice of 284 women students in the Ohio State University.

*During the past three years the writer has directed investigations which concerned those women who were not practicing the "Rules of the Health Game." With assistance from two graduate nurses, Miss Helen Kienzle and Mrs. Dorothy Stillwell, and help from the Student Health Service, the Dean of Women's Campus Committee, the Psychology Department, and the President's Temporary Personnel Council, several noteworthy improvements were made.

Forty underweight women did not take a pint of milk a day.; 99 did not eat three meals daily; 33 complained of "faulty illimination"; "unhealthful ventilation"; "noise"; "lack of adequate toilet and bathing facilities in the homes in which they reside."

Students were taught how to change unhealthful habits; and how to improve sanitation in their homes.

The habit of going beyond the fatigue point is one of women's worst vices. Almost all of the students who admitted that they had deficient sleep showed obvious effects of fatigue such as: low resistance to disease, and lack of skill in activities which require precise movements and concentration. Their output is irregular, and their work is below the production of classmates who are not fatigued. The majority in this group use coffee or tea more than once a day, indulge in coco-cola, and smoke cigarettes. Thirty complained of insomnia. They attributed their inability to sleep to various causes: "troublesome room-mate," "radio in house"; "worries," and "noise."

Some form of milk is necessary for growth. It is a source of calcium, and at least one pint of milk should be taken daily unless the individual has an idiosyncrasy which makes the use of milk inadvisable. It is therefore noteworthy that 64 of the 264 women who did not take a pint of milk daily "deliberately avoided milk"; "causes billiousness," and gave other emperical theories. Forty of these women are under normal weight and show evidences of calcium deficiency. Moreover, they are "always cold," and "prefer to stay indoors on cool days."

The beginning of adolescence marks the increase in the tuberculosis death rate. It is nearly twice as high among girls as among boys. The girls desire to "stay thin," error in diet, and the fashion of wearing insufficient clothing contribute to the tuberculosis rate. Twenty women who thought they "could not tolerate milk" were taught to sip it, and to eat it with a spoon instead of drinking it. They were also encouraged to take orange juice and raw celery with milk. They then had no digestive disorders whatsoever.

Many students do not take three meals daily. Ninety-nine out of 284 "omit breakfast"; 50 of these "don't want breakfast"; 37 women take "only coffee and a bun, or toast, or a doughnut, for breakfast." They said they "did not have time for more." The majority ate: "meat, potatoes and gravy and pie" for dinner.

Nutrition Specialists in the University Department of Home Economics advise as follows: *Food deemed essential as a part of the daily diet include:* 1 quart (at least 1 pint) milk; 1 egg; 1 raw vegetable such as lettuce, cabbage, or celery; 1 citrus fruit or tomato; 1 raw or uncooked green vegetable; 2 slices of whole wheat or graham bread, or 1½ ounces of whole grain cereal. Add one helping of lean meat, potato, and three servings of butter. More fruit and vegetables may be taken. *It is important to drink water between meals.*

One hundred and one women said they "did not want water," eleven complained because cool water is not available in rooming houses. Sixteen students who drank "little or no water" suffered from constipation; coated tongue or "muddy" complexion.

A great deal has been done lately to make the teaching of Hygiene more practical. Teachers and homemakers are more and more concerned with conditions under which individuals must live; and students are now being taught how to change undesirable habits. Students are taught the *features of an Ideal Home.* The sanitation in 23 homes has been improved. The outstanding items of an ideality may be summarized as follows:

No weeds or rubbish are in the yard about the house. Swings, benches, and chairs in the yard or on the porch lure occupants of the house to stay out of doors. The pavement is clean, and is not in need of repairs. A scraper outside of the door encourages occupants and callers to scrape mud from shoes before entering. A mat (of non-absorbent material) on the porch or in the vestibule, affords a place to stand while rubbers and goloshes are removed prior to entering. No one should be obliged to take wet umbrellas, galoshes, rubbers, or slickers into the bedroom. Arrange a place for these near the entrance. If such cannot be arranged, hang wet garments in the hall outside the owner's room door.

The ideal home is screened and is free from odors, has adequate illumination, healthful ventilation, sufficient hot and cold water, prompt disposal of waste, hygienic beds, comfortable chairs, individual desks for writing, tables, and regular quiet hours. These features are now investigated while considering homes for the "approved list" of homes which is endorsed by university authorities.

Adequate illumination means having sufficient light (without glare) to see quickly and adequately. Measured with a meter, desirable illumination on desk tops would register 10–20 foot-candles; 25 or more foot-candles for sewing on dark materials. The source of illumination should always be above the eyes.

Healthful ventilation. Have radiators below the windows so that cold air will be warmed as it enters. Set up deflectors (boards or thick glass) placed at a slant on the inner edge of the window sill. Have a thermometer in each room, and aim to keep the temperature at 68° F.

Regimes in the ideal home encourage each person to begin every day prepared to carry on happily. (Individuals who do not awaken regularly and gladly need to go to bed earlier). Schedules in the bathroom, and dining room should give everyone the opportunity to wash, dress, eat breakfast, and empty the lower bowel before leaving home.

The idea that training of a scientific sort is necessary for health and homemaking is taking hold at present. It makes for the type of intelligence which tends to decrease hazards and contribute to greater happiness.

49. *Basal Metabolism of College Students.*—By C. G. ROGERS AND ROBERT L. KROC, Oberlin College, Oberlin, Ohio.

This paper reports the results of a series of some 222 basal metabolism tests made upon a group of college students, both male and female, and the relation of the basal metabolism rate to the following:

1. Average basal pulse rate.
2. Average basal respiratory rate.
3. Average basal tidal error.
4. College academic average.
5. High school academic average.
6. Strength rating.
7. Percentile intelligence quotient.
8. Values obtained by other workers.

The results of the work appear to justify the following conclusions:

1. The average basal metabolic rate of the men tested was —4.23% below the Aub-DuBois standards and this conforms in general with the results of other investigators on men students between the ages of 17 and 25.

2. The average basal metabolic rate of the women tested was —4.54%. This is only slightly below the value obtained on the men and is about three per cent higher than the averages reported by most other investigators.

3. The average basal respiratory rate of the men was 11.9 per minute and of the women 10.3.

4. The average basal pulse of the men was 58.8 per minute and of the women 67.2.

5. The average basal tidal air was 511 c.c. for the men and 449 c.c. for the women.

6. In general the data on the women tends to support rather than oppose the view that persons of high metabolic rate (within normal limits) have high academic records, intelligence quotients, and strength ratings. This generalization is by no means conclusive for the relationship is quite obscure on the basis of the comparatively few data at hand.

7. The men show a tendency to support the above view only in the case of the high school academic rating.

8. A decrease in basal respiratory rate is definitely correlated with increase in basal tidal air for both men and women.

50. *Silicosis in Ohio Industries: A Preliminary Report.*—By B. E. NEISWANDER, M. D., Consultant, Division of Industrial Hygiene, Department of Health, Columbus, Ohio.

In this preliminary report of the study of silicosis in Ohio industries 30 cases were discussed and the X-Ray films of 10 representative cases were shown. Nine of the 30 cases were sandblasters, only 1 of which had an exposure longer than 7 years; 7 were granite and marble cutters, 6 of which averaged 26 years of occupational life (1 exposure was entire work life); the remaining 14 cases represented 11 various industries. Tuberculosis was a common complicating disease in this series of cases, being present in 15 of the 30 cases studied. It was concluded that the industries of Ohio have not afforded these silicosis victims the protection that should be theirs nor has the State provided legislation as yet to protect them, with or without complications.

51. *The Status of Dental Hygiene.*—By LONZO G. BEAN

The past ten years has witnessed the development of many dental health programs. The more outstanding programs have been summarized in the following pages:

Since January, 1931, the Chicago Department of Health employs eighteen dentists. Fourteen of these men give dental service in fourteen school clinics to children in kindergarten and the first four grades who are unable to pay for private dental care. Four men are employed as dental examiners who examine the mouths of as many children as they can reach in the kindergarten and first four grades.

The Board of Education employs three dentists and five dental hygienists. They are employed as teachers of oral hygiene. Their duties consist of making routine dental examinations and giving mouth hygiene instruction. All of these dentists and hygienists are employed on a full-time basis from 9:00 A. M. until 3:30 P. M., five days a week.

In addition to this service, the Chicago Municipal Tuberculosis Sanatorium employs nine dentists on a part-time basis. Their hours are from 9:00 A. M. until 1:00 P. M. These men perform dental operations for children having or suspected of having tuberculosis.

The Cook County Children's Dental Dispensary, (located at the Cook County Hospital), also employs eight dentists on a full-time basis, who give dental operative service to the poor children of the County.

The Oral Hygiene Committee of the Cincinnati Dental Society worked incessantly during 1900–1910 and until 1916 when this committee became the Free Dental Clinic Society of Cincinnati.

This Society had for its objective the establishment and maintenance of free dental cases, but at the present time, the attention of the public has been turned more to Dental Health Education. This organization placed dental health in and around Cincinnati on a firm foundation and also did much to arouse interest among the members of the Ohio State Dental Society. In 1925 the name was changed to Public Dental Service Society.

During the period from 1911 to 1925, clinics were held and much oral hygiene work was done. At present, the work is financed by the Board of Education and the Community Chest. ($33,450.00 supplied by the former and $10,000.00 by the latter.) There is an advisory committee from the Cincinnati Dental Society that oversees the work in a general way. The work is done by five full-time corrective clinics, one of which is a part-pay clinic, four half-time clinics, one of the four examining and another working for the indigent who are obtaining work certificates. Three floating Prophylaxis Clinics examine.

These clinics are operated by a Supervisor, three full-time dentists, eight part-time dentists, six full-time dental hygienists, a full-time Chief Dental Clinic Assistant, nine full-time dental assistants, one part-time assistant, one part-time clerk and one full-time typist. The Superintendent of Schools is in hearty accord with the program and work that has been done. Under this regime, dental conditions are reported as having improved more than 10% in a period of three years.

Illinois—The aim of the Mouth Hygiene Program of Illinois is to do educational work among school children, parents, and dentists; and the Illinois State Dental Society has a Mouth Hygiene and Public Instruction Committee of about 500 men who have volunteered to aid in carrying out this educational program.

Dr. W. F. Whalen of Peoria, chairman of this committee, has divided the state into districts and appointed district lieutenants and they appoint the dentists of the county as minute men to carry on the program in the county.

In addition to the work as outlined by the State Dental Society, these workers lecture to various lay organizations and to any school system to which they may be invited. Every president of Federated Women's Clubs, and P. T. A. Associations as well as every county superintendent of schools has been asked to assist in this program. Communities have put on a mouth hygiene survey and attempted to have necessary reparative work done but this has not been wholly successful but is rapidly becoming successful through the education of the laity. Several counties, ably assisted by the dental profession, have made mouth surveys and are stressing diet, dental attention, and cleanliness to the school children; prenatal care, diet, and proper dental attention to parents.

At present Illinois is compiling an outline for mouth hygiene education for the first six grades whose aim is to give instruction to teachers for presenting the work.

Iowa—In Iowa, also, the dental health program is largely educational in its work and is carried on through teachers, nurses, dental hygienists, parent-teacher associations and farm bureaus, for the benefit of all grade school children and in some cases is extended to high schools.

No school clinics are held; but table clinics on child dentistry are given for dentists; and schools are held to give nurses instruction in the fundamentals of dentistry. Talks on dental subjects are given at teachers' institutes; and conferences are held with county and city superintendents to persuade them to establish a dental hygiene program in their schools.

These methods have been very successful as the program is now active in the rural schools of 68 of the 99 counties and in the grades of 382 towns and city school systems. However, only 15 of the 68 counties have full-time county nurses and six part-time and only about 50 or 60 towns and cities have full or part-time nursing service, so the work is largely under the direction of the superintendent of schools.

In 1929–1930 they used approximately 500,000 pieces of literature, with many motion picture films and lantern slides. The Sells Health-O-Circus equipment was on the road continuously, carrying lessons in health to thousands of children.

During 1930–1931 the Bureau of Dental Hygiene has extended the work into many new communities—150 towns, cities and consolidated schools and the rural schools of twenty counties.

Sets of lantern slides presenting lessons of dental hygiene are being prepared for grade and high school pupils. The final reports for 1929–1930 revealed that there were 235 towns with an enrollment of 80,213

pupils who were active in the program; and 41 counties with enrollment of 65,911 pupils. 152 towns with an enrollment of 62,318 pupils reported, 32,732 children with returned certificates from their family dentists, and 37 counties with an enrollment of 51,543 reported 16,266 children who did likewise. Four towns were reported as being 100% in dental health. Two other towns would have been 100% but for one or two pupils; and 227 rural schools were awarded 100% certificates.

These figures do not show the actual number of pupils who received full dental corrections, nor the hundreds who received partial work, as some teachers failed to submit reports. Neither can figures adequately represent the benefits derived from dental health education. Results, however, were very gratifying and splendid ground work has been laid for further developments.

Michigan—In Michigan, also, we find the work of the Bureau of Dental Hygiene under the Department of Health is entirely educational because they have no funds for clinic work. So far the efforts of the Bureau have been directed toward nurses, parents and dentists by means of lectures, demonstrations, consultations and educational material.

Since the Chief of the Bureau has no assistant and only a part-time secretary, the work has been done through agencies such as Mothers' Clubs, P. T. A. groups and local dentists; and quite gratifying results have been obtained especially through the nurses and school teachers.

The aim has been to provide suitable educational material and plans simple enough for the country school or rural community, yet which can be enlarged to fit the needs of the larger and better organized communities. The Director spends approximately three-fourths of his time supplementing this by lectures, demonstrations, conferences etc., and has found it to be very profitable.

For the past three years special dental instruction has been given in Normal Schools throughout the State, and the results obtained by the teachers who have had this training has been surprisingly satisfactory. When funds will permit it is planned to extend this service to the nurses' training schools, industrial institutions, etc.

Last year 106,137 pieces of literature were distributed and plans are under way to revise and add to this educational material. It is not easy to give evaluation of actual results from educational and advisory work, but reports are very encouraging.

The Children's Fund of Michigan—Fortunately for the children of Michigan, another source of relief has come in the form of the Children's Fund of Michigan, which was established by Senator James Couzens in April, 1929, with a gift of ten million dollars to be expended within 25 years for the welfare of the children of Michigan and elsewhere in the world.

Naturally some of this is spent for dental hygiene work and is under a Director of the Dental Division of the Fund. The Chief of the Bureau of Dental Hygiene of the City of Detroit Health Department is a member of the Dental Advisory Committee of the Children's Fund of Michigan, and in close touch and absolute harmony with the program that has been inaugurated.

The first dentist was employed on November 25, 1929. From that date until the present time, March 23, 1931, the so-called Regular Field Dental Staff was augmented from month to month until it now numbers 22 dentists and 4 oral hygienists, operating in 33 counties and 2 urban areas. (Both dentists and hygienists are employed on a full-time basis. These people are given complete dental units and equipment supplies are furnished without charge to the counties.

Before this help is given there are certain requirements that must be met by the counties as follows: First, the county must provide a nurse; second, the county must provide suitable operating quarters for the dentist, and form a Dental Advisory Committee which shall formally ask for this aid and then advise with the dentist who may be sent.

At present the work does not include X-ray and orthodontic service, although the Fund pays local dentists for X-ray work. The aim is eventually to examine and record mouth conditions of every child in the county and give prophylactic treatment. Notices are sent to parents of children who need corrective treatment, and if parents are financially unable to pay for this, all work necessary to put the child's mouth in 100 percent condition from a health standpoint will be done free of charge in the dental clinics.

It is expected that five years of such work will have proved its economic value and the counties will then take over the program.

Pennsylvania—The Dental Division of the Pennsylvania Department of Health has as its fundamental objective the spreading of propaganda to interest local school districts in the establishment of educational preventive dental health work by means of the dental hygienist. This is done by demonstrations and addresses given before School Boards, Service Clubs and other Civic groups.

The Division does no practical work in any particular community. But in addition to the propaganda before mentioned they have a Supervising Dental Hygienist who spends almost her entire time visiting approximately 150 dental hygienists engaged in school work in the state. One hygienist is able to care for about 1,500 children.

Shorewood—During the past year (May 1, 1929–April 30, 1930) charted mouth examinations have been made for each child from the first to the sixth grade; 63.1% of the children were found to have defective teeth, ranging in number from one to ten or twelve; and pupils of the third and fourth grades were found to have the highest average of defects per child. Corrections have been most satisfying and it is interesting to note that 73.8% of the mouths inspected now have had all necessary corrections made by the dentist. Three rooms, having 30 or more children in each, have 100% corrections; and 15 rooms have from 90% to 94% of the pupils on the Dental Health Roll.

Mal-occlusion or mal-formation of the dental arch was found in 252 children. Of these, 78 now wear orthodontic appliances and many more will be under treatment as soon as the permanent sets of teeth are fully erupted.

The number of cavities found in first permanent molars was most astonishing, while 63 children had lost one or more of these very valuable

teeth. Prophylactic treatments were given to 590 children. This half-hour of individual attention gave opportunity for the dental hygienist to get the co-operation of the child in the care of his mouth. Last year 1,492 children were given dental examinations; 480 corrections were made; 900 were referred to a dentist; 1,105 had defective first permanent molars; and 94 had had first permanent molars extracted by a dentist.

Plans for the current year include a Dental Health Exhibit as a project in health education. Pupils will build the exhibit and when parents are invited to visit it, the pupils will give talks on the different phases of Mouth Hygiene and Dental Health Service.

Territory of Hawaii—Hawaii has developed a most interesting and effective plan whereby a staff of 25 dental hygienists together with a supervisor do both prophylactic and educational work, and are classed as special teachers. There are also clinics conducted by dentists, which are unique in that they are most effectively conducted although necessarily decentralized.

There are 189 schools and all but 4 of them were provided with dental service in 1930. In fact the total number of pupils who failed to receive dental education and care were less than 100, and their isolated situation is the only reason they did not have it.

So complete and effective is the program carried on under the Division of Dental Hygiene in Hawaii that it places the territory in advance of most of the States of the Union in this "most important subject."

A few of the cardinal results from dental clinics are:

1. Better physical fitness.
2. Fewer failures in schools.
3. Less years to complete school work.
4. Sending forth a child more physically fit, mentally alert and morally right.
5. Hence, a better citizen.

52. *The Blood Pressure of an Opossum.*—By H. E. HAMLIN, Ohio State University, Columbus, Ohio.

While under ether-urethane anaesthesia, the mean carotid blood pressure of a female opossum was measured directly by the use of a standard mercuric sphygmomanometer on January 31, 1931. This animal had been caught in November, 1930, and kept in the laboratory to the date of this experiment. It was interesting to find that its carotid pressure compares favorably with that of other mammals, the normal pressure varying between 102 and 105 mm. Hg. This, however, rose to 130 mm. Hg. after section of the vagi. The normal pulse rate varied between 192 to 198 beats per minute, but was increased to 216 after cutting the vagi. Adrenalin, sensory stimulation, stimulation of the peripheral ends of the divided vagi, asphyxia, gave results similar to those obtained from other mammals under the same conditions.

53. *Further Studies on Gastric Ulcer.*—By SHIRO TASHIRO AND LEON H. SCHMIDT, The Department of Biochemistry, University of Cincinnati, Cincinnati, Ohio.

Based on the following facts brought out in our laboratory during the last few years through investigation of experimental gastric ulcer, we have proposed a theory that the human gastric ulcer is the result of faulty phospholipid metabolism: (1) Tsuruta found that phospholipids antagonize the bile salts in the production of gastric ulcer in the guinea pig and that such physiological conditions as sex and seasonal variation in which phospholipid metabolism is altered also change susceptibility to bile salt. (2) We showed that an experimental condition that produces a change in phospholipid metabolism, such as hyperthyroidism, makes the animal more susceptible to the bile salts. (3) We also showed that most agencies known to produce experimental gastric ulcer cause profound changes in the blood phospholipids.

Whether this decreased phospholipid per se is responsible for the ulcer, or whether the bile salts become more toxic because of the decrease of this antagonizer is yet to be determined.

54. *Sex-Character Education Through Pets.*—By WILLIAM G. VINAL, School of Education, Western Reserve University, Cleveland, Ohio.

(An experiment with children at the Nature Guide School of Western Reserve University.)

Abraham Lincoln had a distinct educational advantage. For half of his life he lived in a log cabin and twenty-two of these years on a farm. His course of study consisted of the three R's, for about eight weeks in the winter. From the age of seven to eleven he had no formal schooling. His major work, therefore, was extra-curricular.

His Botany was mostly research. He wielded a crude but effective weapon, with which he became acquainted with approximately thirty species of trees that grew on the Indiana Lincoln farm.

He had a semester of Zoology. That, too, was of the extra-curricular variety. He knew the wild mammals of the forest together with the wild turkey and passenger pigeon. His experiences differed from the present laboratory courses in that he had to match wits with the hog, horse, and ox. In comparative anatomy the liver and "lights" were a reality. For preservative he used brine instead of formaldehyde. It may not be amiss to emphasize that each activity was research with a purpose.

His arts and crafts had to do with tools and home-made furniture. He learned swimming in the deep holes of Knob Creek, Larue County, Kentucky. At nineteen he was qualified for "the crew," when he had succeeded in taking a flat-boat down the Ohio and Mississippi to New Orleans. His graduate work in social science, surveying, and law was studied while a storekeeper at New Salem, Illinois.

Lincoln's education was effective, yet few of us would dare to send our children to his school. Since his day homestead industries have been moved to the factory. Cows, pigs, and horses are equally a closed

book. The city has taken away the "chores," the great educating power of the past, and placed the child on pavements and alleys. It is during this extra-curricular period of five hours a day that the child gets his real character. Whether this leisure time becomes an asset or liability is important. It is plainly the duty of the city to give back to the child the things that the city has taken away from him.

This paper can deal with but one item of this intricate problem. What do we find in our modern society that is taking the place of the animal education of the farm? Does one anemic gold fish in a glass jar take the place of breaking in the colt? Does a duck baking a loaf of bread for the hen and going wee wee all the way home give the same mental stimulus as the hatching of a chick? Is dusting the erasers and emptying the waste paper basket a substitute for "chores"? It is like asking if there is any substitute for sunshine, or fresh air, or flowers, or grass, or birds? Have not you as scientists been guilty of being so engrossed in your work that you have not questioned what has been given your children? By the very nature of your profession you will agree that there is no substitute for biology. Any failure on your part to demand that your children experience the fundamentals of life will be disastrous. This is one of the most significant and important problems that biologists face today.

One of the experiments at the Nature Guide School of Western Reserve University has been the Pet House. It is my purpose to give a brief summary of the activities at the pet house with the aid of lantern slides. The animal house is located on a lake which gives it many self-evident advantages. Each morning 16 girls, under leadership, do the "chores." The newspapers on the zinc trays are rolled up and fresh ones put in their place. The animals are given water, correct food, and exercise. If young have been born, they are given proper attention. All of this furnishes a basis for wholesome work, joyful play and interesting conversation.

Take the woodchucks for instance. When young they are given a nursing bottle. I do not know of a prettier picture than a group of young girls watching a groundhog nursing. For his vitamines he may indulge in clover instead of lettuce. In this picture they might be called "pals," as both animals are eating at one time from the same carrot. It so happens that what is good for baby woodchucks is good for young humans. One little girl asked her mother if she could have carrots for the rabbit. Her mother said: "I cannot afford to buy carrots for the rabbit, but if you will eat the carrots you may have the peelings for the rabbit." This little girl became the champion carrot eater of Cuyahoga County. The carry-over of food habits is astonishing. Many a child will unconsciously get the point through animal study and will resist the same knowledge through preachment. To hobnob with a woodchuck over a long period of time is instructive adventure. Eventually the woodchuck begins to store up for hibernation. His care-taker is continually building up right health and food attitudes.

Each animal makes its particular contribution. The American Bittern is carnivorous instead of a vegetarian. To catch 14 frogs for a bittern's breakfast is a responsibility. The horned toads were fed by

means of a baited fly trap. Conversation about handling the pregnant mother rat, the birth of the young, the suckling of the young, the mammary glands, the milk, was natural, wholesome and truthful. It would not be necessary to mention this if there had not been so much false modesty and untruthfulness in the past.

Another attitude that develops is a regard for scientific accuracy. The children learn that truth is stranger than fiction. Each day an egg is opened to show the development of the chick. This 3-weeks miracle is more wonderful than the story of evolution itself. It will be noted that it is not necessary to put a beaver hat on the chickens to get interest, nor does the mother hen wear a thinking cap nor does the half-chick go to see the queen. The modern princess sits right down with the chickens and partakes of the great lessons of life.

Somewhere along our educational pathway the child is sure to learn about gruff bears eating little folks, about toads and warts, certain classical lies about snakes and the other thousand-and-one myths of Aesop. That this mis-information is learned early is seen in our children, but that it is a mental hazard is also realized as one works with them.

Humaneness is another by-product of the pet house. The command, "Be Kind" is probably not mentioned any more than the phrase "we are studying sex." Attitudes are a result of habits. It does not occur to anyone to tie a tin can to the rat's tail, nor to twist the tail of the 'possum, any more than it does to ask who brought the baby rabbits or if they came from Easter eggs. Unconsciously the children are obeying the same laws of humanity in taking care of squirrels and hawks that are called for between nations.

The pet work is not without a mental challenge. Take the bringing up of a calf, for instance. It takes brains to educate a calf for human control. One must know how to guide him during his playful moods. There is a definite way of teaching him to drink milk when weaning him. To become a useful cow the calf has to be taught certain things. As a matter of fact the calf is teaching the child. Receiving a degree is not necessarily an indication that one is properly trained to rear a calf.

The bringing up of an animal may include all the important phases of education. Take Mordecai Jones selling vegetables with his goat cart and Shepherd dog. Try to short-change him and you will gain respect for his arithmetic. Throw a stone at his dog and you will get an indication of his humaneness. Take hold of his arm and you will know that he has not had soft-pillow bringing up. Invite him to idle his way and learn that he knows the necessity of self-management. Give him an order for future delivery and you will learn of his responsibility. Be helpful and sympathetic and learn how habits and character can be acquired through vital processes. Such are the gifts that come from a study of animals—their nutrition, habits, parenthood, and control.

E. THE SECTION OF PSYCHOLOGY.

DR. JAMES P. PORTER, Ohio University, Athens, Ohio,
Vice-President.

55. *Preliminary Report on A New Diagnostic Technique for Studying Social and Emotional Adjustment.*—By O. A. OHMANN, Cleveland College of Western Reserve University, Cleveland, Ohio.

The test consists of descriptions of 28 typical face-to-face social situations, selected on the basis of frequency of mention by groups of college students. For each of these problem situations a number of possible responses are listed. Among these will generally be found five types of maladjusting behaviors and two types of healthful responses.

The subject is asked to indicate for each of the possible behaviors listed, whether he uses it frequently, occasionally, rarely, or never.

The individual's total score on each of the seven types of social behavior is translated into standard deviation units, from which a diagnostic profile may be constructed. By summing an individual's deviation scores on each of these types of behavior a single total deviation score, or "social adjustment index" may be obtained.

F. THE SECTION OF PHYSICAL SCIENCES.

DR. L. W. TAYLOR, Oberlin College, Oberlin, Ohio,
Vice-President.

56. *A Determination of the Dielectric Constants and Densities of Brom-Benzene—Hexane Solutions, and the Determination of the Electric Moment of the Brom-Benzene Molecule.*—By LOUIS M. HEIL, Ohio University, Athens, Ohio.

In the determination of the electric moments of molecules by the Debye theory, two methods are used:

1. To measure the total polarization at a single temperature and make use of the electronic polarization as given by optical data.

2. To measure the total polarization at different temperatures. The first method leads to erroneous results for the electric moment if an atomic polarization is present.

In this investigation the second method was used. The dielectric constants and densities of mixtures of Brom-benzene in non-polar hexane were measured from —60° C. to 60° C. for molar concentrations of .04 to .20. These data gave polarizations, that when extrapolated to zero concentration, gave an electric moment for the Brom-benzene molecule of 1.38 10-18 electro-static units. This is in agreement with the behavior of substituted molecules as the electric moment of the substituted molecule decreases with increase in atomic weight of the substituted molecule and since the Chlor-benzene molecule has an electric moment of 1.53 10–18 electro-static units.